Reviewer 1

General comments: The manuscript titled “Soil carbon, nitrogen, and phosphorus storage in juniper-oak savanna: Role of vegetation and geology” is a well-written manuscript that explores how geological factors may interact with woody plant encroachment to influence soil C, N, and P biogeochemistry. The importance of this study is twofold: 1) climate change and certain types of land management are accelerating woody encroachment into grasslands and it’s important that we understand how this shift influences soil properties; and 2) it’s critical that we understand how geology and vegetation changes interact, as findings can help improve modelling efforts for soil C, N, and P dynamics in various ecosystems going forward. The authors present clear figures and include site photos, which made for a pleasurable read.

Specific comments:

Intro – Well written! May be helpful to include a brief explanation of how the interaction between soil depth and δ13C of SOC can inform us on the history of the landscape (i.e., Fig. 3a). It would help set up your hypotheses, results, and beginning of your discussion section nicely for those who are less familiar with this concept.

Thank you for your suggestions. I have added these sentences into L89:

… grass vs. woody sources of soil organic matter. Grass species in the Edwards Plateau generally use C_4 photosynthesis, resulting in different δ^{13}C values compared to the encroaching woody species, which use C_3 photosynthesis (Boutton et al., 1998). Changes in the δ^{13}C signatures at different soil depths can reveal historical shifts in predominant vegetation, possibly due to climatic changes, disturbances, or human activities (Jessup et al., 2003; Zhou et al., 2019). We tested the hypotheses that…

Line 109 – can you specify if this higher clay content is across the entire soil profile or across some specific depth?

Thank you for bringing this to our attention. To clarify, I have modified the sentence as:

“The clay content in Buda soil is generally 2-5 % lower than that in Edwards soil throughout 0-40 cm soil profile based on USDA/NRCS data”. (L120)

Fig 1 – Great idea to include photos of the Edwards and Buda soils. I think it’s helps readers better understand the differences between them (i.e., depth).

Thank you!

Lines 127 – 129 - Would be useful to add % forage utilization in parentheses here for context on how 'light grazing' vs. ‘heavy to moderate grazing’ is being defined.

Thank you for your suggestions. I have adjusted the sentence as:

"Grazing in this area was heavy (2 - 5 ha/animal unit/yr) to moderate (6 - 8 ha/animal unit/yr) from approximately 1880 to 2010, but the area chosen for this study was grazed lightly (9 - 15 ha/animal unit/yr) and intermittently for the past 10 yrs (Leite et al., 2020). Since 1948, the livestock composition in these grazed areas has maintained an approximate ratio of 60:20:20 for cattle, sheep, and goats, respectively (Marshall, 1995)". (L142-145)

Lines 138 – 139 - Please extrapolate/clarify what you mean by 'within the middle of each depth increment'. I believe you mean 5 cm in the 0-10 cm increment – if you specify this, it will align with the figures better.

Thank you for your suggestions. I modified the sentence as:

"… We aimed for the midpoint within each specified depth range for sampling. For instance, samples were taken at 5 cm for the 0-10 cm range, 15 cm for the 10-20 cm range, 30 cm for the 20-40 cm range, and so forth. Each sampling point involved the horizontal insertion of two soil cores (7.6 cm width x 10 cm length) into the trench face." (L155-158)

Table 1 & Table 2 – please consider removing lines between rows in the tables. If this is required formatting, then ignore. Otherwise, I suggest removing and formatting according to journal requirements.

Thank you for your suggestions! I have removed the inside horizontal lines.

Lines 172 – 173 – The way this is written throws the reader off a little bit. Please consider rewriting as: "The fraction, (*f*), was the proportion of SOC derived . . ." or something similar.

Thank you for your suggestions. I modified the sentence as:

The fraction, (*f*), was the proportion of SOC derived from C_4 plants and (1 – f) was the proportion of SOC derived from C_3 plants. (L192)

Lines 201 – 202 – If you weren't able to get BD measurements >20 cm for Edwards soils, how were you able to accurately make SOC predictions past 20 cm (Fig. 4a)? From what I recollect, von Haden requires BD for the input sheet and R script.

This is a great question. Indeed we encountered limitations in getting bulk density for Edwards soil beyond 20 cm depth. Thus, we used a cubic-spline extrapolation method to estimate cumulative SOC stocks from 0-40 cm soil layer based on data from 0-10 and 10-20 cm (L199) (Wendt and Hauser, 2013). Then, we can get SOC stock within 20-40 cm soil layer based on the difference between cumulative SOC stocks from 0-20 and 0-40 cm soil layers.

Lines 208 – 209 – can you clarify what you mean by . . . “the fact that SIC increased more strongly with soil depth beneath oak than beneath grassland or juniper vegetation”. Is this based on the slope of the lines in fig 2d? And is it pertaining to across all depths? Just glancing at the figure, it appears the biggest change in SIC between the first and second depth increment is for grass.

Thank you for highlighting this discrepancy. I recognize that there was an error in my initial interpretation presented in the manuscript. I revised the sentence on L228 as:

“… the fact that SIC at the 15 cm and 30 cm depths was substantially higher than at the 5 cm depts beneath grassland than beneath oak or juniper vegetation (Fig. 2d)”.

Table 2 – Very interesting and surprising that depth alone did not significantly affect SOC. Only the interaction between geology and depth. I suggest capitalizing Depth, Vegetation Geology in the table to make the abbreviations even more intuitive.

Thank you for your suggestions. I have capitalized Depth, Vegetation Geology in Table 2 and S2.

Fig. 3a – I like the inclusion of δ13C litter values in the same figure as δ13C soil values. However, I would add a statement indicating exactly what the dashed line on the figure indicates in the figure caption for further clarity.

Thank you. I have modified the captain of Figure 3 (L252):

“Changes in (a) δ^{13}C of litter (above dashed line) and soil, and (b) the fraction of SOC derived from C_4 grass beneath juniper and oak in soils derived from the Buda vs. Edwards formations calculated using mass balance. Results are given as means ± standard errors of the mean. Data are plotted at the midpoints of the depth increments.”

Line 244 – perhaps change to … “while **only** oak had higher SOC and TN on Buda soils”. It reads a little easier that way.

Thank you. I agree to revise the sentence as:

” Soils beneath live oak and Ashe juniper had higher SOC and TN than grasslands throughout the profile on Edwards soils, while only oak had higher SOC and TN on Buda soils (Figs. 4a and c).” (L264)

Line 306-307 – is it plausible that higher clay content in the Edwards soil could have increased soil C relative to Buda as well? You make a point in the methods that the Buda soil has less clay content.

Thank you. You are correct that differing clay contents between the Edwards and Buda soils could influence the respective carbon storage capacities. I revised the sentence on L330-333 as:

We speculate that the higher concentrations of C, N, and P in soils atop the Edwards limestone could be attributed to two factors: First, the higher clay concentration which offers a higher C storage capacity

(Six et al., 2002; Basile-Doelsch et al., 2020) and second, the shallow depth to bedrock (approximately 40 cm) in Edwards soil that constrains root and litter inputs to a limited soil volume.

Discussion – towards the end of the discussion, it would be helpful to briefly address other ecological effects of woody encroachment that were not directly measured in this study (i.e., biodiversity, soil erosion, etc.). It would make sense to add this sentiment after your point about SIC loss with encroachment (line 347).

Thank you for your suggestion. We recognize the importance of these aspects; however, we believe that including a detailed discussion on topics such as biodiversity and soil erosion might shift the specific focus of our manuscript, which aims to elucidate the interactions between geological factors and woody plant encroachment concerning soil C, N, and P biogeochemistry. Nevertheless, understanding the significance of these points, we propose two potential approaches to acknowledge these important ecological contexts without deviating from our core findings:

1. Within the Discussion section, we could subtly integrate these points as an additional paragraph following section 4.3 Soil stoichiometry. Here's a proposed addition:

   "Recognizing that the altered soil nutrient dynamics have far-reaching ecological consequences, the impact of woody encroachment might extend beyond biogeochemical changes. For instance, the modification of microclimatic soil conditions and suppression of herbaceous diversity under woody canopies could influence broader biodiversity (Archer et al., 2017). Furthermore, the disparity in soil nutrient availability between soils under canopies and nutrient-deprived interspaces (Figs. S1 and S2) may escalate the risk of soil erosion in drylands (Puttock et al., 2014; Ravi and D'Odorico, 2009; Wilcox et al., 2022). These considerations, while beyond the primary scope of our current investigation, highlight the multifaceted impacts of woody plant encroachment on arid and semi-arid ecosystems." (L403-409)

2. Alternatively, we could condense these ecological effects and incorporate them into the first paragraph in the Introduction.

Either way, we appreciate your guidance on whether a broader context in the Discussion or a brief mention in the Introduction would be more appropriate, or if another approach might better serve the manuscript.

Conclusion – As is, the conclusion is quite long. Please distill and shorten where appropriate – focus on **what** was found and **why** it's important.

Thank you for your suggestions. I have rewritten the Conclusion as:

This study investigated the impact of *Juniperus ashei* and *Quercus virginiana* encroachment on soil C, N, and P stoichiometry in mixed grass prairies on the Edwards Plateau of central Texas, considering the influence of underlying geological variations between soils lying atop two different limestone parent materials – the Buda vs. Edwards formations. Stable C isotope ratios ($\delta^{13}C$) of soil organic matter revealed that 45-90 % of soil C in the 0-40 cm depth interval beneath juniper and oak stands was derived from C_4 plants, confirming that these woody plants were recent components of the landscape. Vegetation and geology interaction significantly influenced soil C, N, and P levels, with higher values under juniper and oak canopies than grasslands and on soils derived from the Edwards formation, possibly due to higher clay content and limited soil volume due to shallow depth to bedrock (approximately 40 cm). Conversely, the deeper Buda formation (> 1 m) allowed more extensive root and litter distribution, resulting in lower element concentrations. Soil C:N, C:P, and N:P ratios were generally higher under woody plant canopies compared to grasslands, indicating that woody encroachment increased SOC and TN relatively more than TP. While C and N consistently increased — likely because of their close linkage during primary production, respiration, and decomposition — P trends deviated, reflecting influences from geochemical processes. Our results are broadly consistent with prior studies around the world showing that woody plant encroachment into arid/semiarid ecosystems generally results in increased concentrations and pools sizes of soil C, N, and P, as well as changes in their stoichiometric relationships. Our study also suggests that the magnitude of these changes may be influenced by attributes of the geological formations that underly the soil. Given the geographic extent of woody encroachment at the global scale, our results have important implications for the management and conservation of these ecosystems. We suggest that interactions between vegetation changes and geology warrant consideration in future studies and could play a role in efforts aimed at improving the prediction and modeling of soil C, N, and P storage in grasslands, savannas, and other dryland ecosystems. (L411-430)

Reviewer 2

General Comments

This study quantified soil properties by depth (SOC, δ13 C, nitrogen, and phosphorus) under contemporary ecological conditions (grassland, juniper, and oak) on different ecological sites (by depth and parent material; Edwards, Buda) to evaluate impact on the soil's biogeochemistry. Results show that grass to woodland transition is relatively recent, and that vegetation transition dynamics and soil parent material uniquely condition soil nutrient stores. My main concern regards conclusions related to land use change (grass to shrub) absent of long-term data (quantification of ecological state change over time) or a more specific soil-chronosequence study (space for time substitution, better control of soil type and soil age). Here are a few suggestions for the authors to consider on revision.

The presence of a petrocalcic horizon in the Prade (Edwards) and Valera (Buda) soils infer these soils are pedogenically much older than the Eckrant (Edwards) and Tarrant (Buda) soils. Valera also has a different soil family texture class (fine) than the other three (clayey skeletal). Can the authors provide the soil taxonomy and geographic locations for the soil trenches in Table 1? This will significantly add the soil and landscape interpretation. Without this information, "shallow depth to bedrock" (L385) for the Prade and Valera soils could be confused with the "depth to petrocalcic horizon". Petrocalcic horizons are considered 'pedogenic' (atmospheric additions with soil translocations and transformations) and limestone/marl is older, or 'geogenic'. Without these data, authors could maintain some their assumptions of soil behavior (shallow vs deep), however, conclusions of geology's role are more complicated.

Thank you for your insightful comments. I propose the following modifications to the soil pedology section 2.1 and Table 1. Please note that although the profiles of some sampling locations within Trench 1, 2, 5A, 5B, and 6 have been described and published in Soil Pedon Description (attached as appendix to this Reply to Reviewer document), the extensive length of some trenches indicated the presence of multiple soil series. In our revised paragraph, we provide both the depth to bedrock and depth to caliche (petrocalcic or paralithic) horizon. It is worth noting that the caliche layers in Trench 5A, 5B, and 6 were unconsolidated, and root growth was observed within the caliche layers.

Revised revision of pedology paragraph (L104-130):

The Edwards Plateau is an uplifted and dissected limestone plateau (karst topography) with gentle slopes. Soils in this region are clayey Mollisols with shallow soils on plateaus and hills, and deeper soils on plains and valley floors (Gabriel et al., 2009; Wiedenfeld and McAndrew, 1968). The predominant soil map units on plateaus and hills are the Eckrant – Rock outcrop complex and the Prade – Eckrant complex. These include the commonly occurred Harper (clayey, smectitic, thermic Lithic Haplustolls), Prade (Clayey-skeletal, smectitic, thermic, shallow Petrocalcic Calciustolls), and Tarrant soil series (clayey-skeletal, smectitic, thermic Lithic Calciustolls) , all of which lie atop the Edwards formation (Wilcox et al., 2007). These soils contain large amounts of limestone fragments and limestone outcrops. Depth to bedrock for these soils was generally < 0.4 m (Figs. 1 and S1). The clay content in the top 5 cm of Edwards soil is 30-40% and increases with depth to almost 50% at 20 cm depth (Marshall, 1995). The soil map unit commonly occurring on plains and valley floors is Valera clay, including Rio Diablo (Fine, mixed, superactive, thermic Aridic Haplustolls), Ozona (Loamy, mixed, superactive, thermic, shallow Petrocalcic Calciustolls), and Mereta (Clayey, mixed, superactive, thermic, shallow Petrocalcic Calciustolls), which lie atop the Buda formation (Wilcox et al., 2007; Gabriel et al., 2009). These soils are generally deeper than those lying atop the Edwards formation and contain hard limestone and a caliche layer on top of the limestone bedrock (Figs. 1 and S1). The caliche layer, typically light in color, can manifest as either the petrocalcic (Bkkm horizon) or the paralithic (Cr) layer, both potentially cemented or unconsolidated. The petrocalcic layer is comprised of weathered carbonate and cements the B horizon with soil particles (Soil Survey Staff, 2014), while the paralithic layer is a residuum from limestone weathering. The clay content in Buda soil is generally 2-5 % lower than that in Edwards soil throughout 0-40 cm profile based on USDA/NRCS data (Official Soil Series Descriptions (Rio Diablo series), 2022; Official Soil Series Descriptions (Eckrant series), 2022; Official Soil Series Descriptions (Valera series), 2022; Official Soil Series Descriptions (Prade series), 2022). Depth to consolidated bedrock for Buda soils was approximately 1.5-2 m, while depth to the caliche layer was approximately 0.5 m. Although the hard limestone geological formations underlying both the Edwards and Buda soils have contributed somewhat to the formation of these soils, there is considerable chemical and physical evidence indicating that these soils are derived largely from an overlying limestone residuum with distinctly different attributes than the underlying limestone (Rabenhorst and Wilding, 1986a, b; Cooke et al., 2007). The Del Rio Clay, an Upper Cretaceous marly limestone that locally overlies the Edwards limestone, has been proposed as the dominant source of these soils (based on texture, mineralogy, and Nd isotope composition), at least on the eastern portion of the Edwards Plateau (Cooke et al., 2007).

Table 1. Geological substrates and physical dimensions of soil trenches.

Trench	Geological formation	Average depth (m)	Length (m)	Soil series	Landscape	Coordinates

1	Edwards	0.7	30	Haper – Prade	Footslope	30°17'22.6"N, 100°33'33.0"W
2	Edwards	0.4	8	Tarrant	Summit	30°17'22.4"N, 100°33'12.1"W
4	Edwards	0.4	14	Tarrent	Summit	30°16'48.4"N, 100°33'37.8"W
5A	Buda	1.5	20	Prade – Ozona	Footslope	30°15'20.1"N, 100°34'21.5"W
5B	Buda	1.4	9	Rio Diablo	Toeslope	30°15'18.9"N, 100°34'19.8"W
6	Buda	1.4	12	Mereta – Rio Diablo	Toeslope	30°17'00.0"N, 100°32'27.9"W

Specific Comments:

L21, L398, “results have important implications for the management and conservation of these ecosystem”. Can the authors add to the discussion management suggestions and implications?

We proposed a modification in L425-430:

Our study also suggests that the magnitude of these changes may be influenced by attributes of the geological formations that underly the soils. Given the geographic extent of woody encroachment at the global scale, our results suggest that soil conservation practices might need to be tailored according to the underlying geology. Interactions between vegetation change and geology warrant consideration in future studies, and could play a role in efforts aimed at improving the prediction and modeling of soil C, N, and P storage in grasslands, savannas, and other dryland ecosystems.

L85, is the first mention of δ13 C to test woody encroachment. Given that δ13 C is used to conclude grassland to woodland conversion (L381), consider adding to the introduction how carbon isotopes are used as proxy to identify relative abundance C3 and C4 vegetation.

Thank you for your suggestions. I have added these sentences into L89:

… grass vs. woody sources of soil organic matter. Grass species in the Edwards Plateau generally use C_4 photosynthesis, resulting in different δ^{13}C values compared to the encroaching woody species, which use C_3 photosynthesis (Boutton et al., 1998). Changes in the δ^{13}C signatures at different soil depths can reveal historical shifts in predominant vegetation, possibly due to climatic changes, disturbances, or human activities (Jessup et al., 2003; Zhou et al., 2019). We tested the hypotheses that…

L101, L104, include the taxonomy for each soil class. Eckrant is “Clayey-skeletal, smectitic, thermic Lithic Haplustolls”; Prade is “Clayey-skeletal, smectitic, thermic, shallow Petrocalcic Calciustolls”; Valera is “Fine, smectitic, thermic Petrocalcic Calciustolls”; Tarrant is “Clayey-skeletal, smectitic, thermic Lithic Calciustolls”.

Thank you for your suggestions. Soil taxonomy were provided in the proposed revision. Please refer to the response to general comments.

L104, Valerna should be Valera.

Thank you for pointing out this mistake. I have corrected it.

L110, is the only mention of the Rio Diablo and Ector soil series. Are these series identified in the study? Do these soil series add any additional information to the study (Buda vs Edward)?

Thank you for your suggestions. Rio Diablo is one of the major soils atop Buda limestone. For example, trench 6 is located in Rio Diablo silty clay soil mapping unit. Ector soil series is a commonly observed soil lying atop Edwards limestone in Edwards Plateau (Gabriel et al., 2009). As none of the trenches in this study were located in an Ector-related map unit, we agree to remove Ector soils from the references for clarity.

L107, Bkkm is a “petrocalcic horizon” (pedogenic), avoid calling it marl (geogenic).

Thank you for your correction. Please note that the caliche layers in soil profiles of Trench 5 and 6 (both Buda limestone formation) is different. According to soil pedon descriptions, the yellow-whitish layer of Trench 5 is unconsolidated paralithic (Cr) layer weathered from limestone. The gray fractured layer between A and Cr horizons in Trench 6 is petrocalcic (Bkkm) horizon. Please see the figures below. This interpretation is supported by the findings of a previous study near the Sonora station (Rabenhorst and Wilding, 1986a).

We also added Figure S3 below to the supplemental materials.

Figure S3. Trench 5A (a) and Trench 6 (b) in Buda soil at Texas A&M AgriLife Sonora Research Station on the Edwards Plateau, Texas.

L129, can authors provide more information regarding the historic land cover conversion dynamics at these locations? Such as the historic rate and magnitude of the grassland to woodland conversion in the study area? I suspect that the TAMU Sonora station has this data.

Although we do not have records of grassland to woodland conversion rates at our locations, woody cover was shown to increase from 7.6% to 19.3% between 1986 and 2020 in other portions of the Sonora station, corresponding to average annual increase of 0.8% per year (Leite et al., 2023). This rate is comparable to regional observed in South Texas and Oklahoma, where annual increases in juniper cover averaged 0.5-1.5% per year (Barger et al., 2011; Archer et al., 2001; Fowler and Simmons, 2009; Wang et al., 2018). (L316-320)

L136, can you add a simple rational for the depth intervals used in the study.

We added those sentences into L136:

…particularly those atop the Edwards formation. Soil depth intervals were selected to represent soil horizon patterns described in USDA/NRCS Web Soil Survey and comparability with previous studies of the study area. Within the middle of each depth increment,… (L154-155)

L146, Table 1, can you provide specific site characteristics (landscape position), taxonomic classes, and the geographic coordinates for the trenches? Site characteristics and Soil taxonomy will add to the interpretation, and coordinates will help confirm any soil-landscape relationships previously identified by soil survey.

This is a great suggestion. Please see the revised version of Table 1 as below. Please note that Trench 5 spans the landscape from footslope to toeslope according to the pedon descriptions.

Table 1. Geological substrates and physical dimensions of soil trenches.

Trench	Geological formation	Average depth (m)	Length (m)	Soil series	Landscape	Coordinates
1	Edwards	0.7	30	Haper – Prade	Footslope	30°17'22.6"N, 100°33'33.0"W
2	Edwards	0.4	8	Tarrant	Summit	30°17'22.4"N, 100°33'12.1"W
4	Edwards	0.4	14	Tarrent	Summit	30°16'48.4"N, 100°33'37.8"W
5A	Buda	1.5	20	Prade – Ozona	Footslope	30°15'20.1"N, 100°34'21.5"W
5B	Buda	1.4	9	Rio Diablo	Toeslope	30°15'18.9"N, 100°34'19.8"W
6	Buda	1.4	12	Mereta – Rio Diablo	Toeslope	30°17'00.0"N, 100°32'27.9"W

L171, I am not familiar with what appears to be a simplified formula to determine the C4 fraction. A more precise formula uses an end member mixing model of two sources: $\%C_3 = [(\delta^{13}_{Cs} - \delta\ ^{13}C_{C4})/(\delta^{13}C_{C3} - \delta\ ^{13}C_{C4})] \cdot 100\%$, and then calculates from, %C4 = 100 – %C3, (Phillips & Greg, 2001, Oecologia).

These two equations are equivalent:

$\%C_3 = [(\delta^{13}_{Cs} - \delta\ ^{13}C_{C4})/(\delta^{13}C_{C3} - \delta\ ^{13}C_{C4})]$

$(1 - \%C_4) \times (\delta^{13}C_{C3} - \delta\ ^{13}C_{C4}) = \delta^{13}{}_{Cs} - \delta\ ^{13}C_{C4}$

$\delta^{13}{}_{Cs} = (1 - \%C_4) \times (\delta^{13}C_{C3} - \delta\ ^{13}C_{C4}) + \delta\ ^{13}C_{C4}$

$\delta^{13}{}_{Cs} = (1 - \%C_4) \times \delta^{13}C_{C3} - \%C_4 \times \delta\ ^{13}C_{C4}$

Please note that the formula adopted in our study has been developed by previous studies (Jessup et al., 2003; Boutton et al., 1998).

L172, was C4 and C3 tissue collection completed at each trench (such as the litter in Fig 3a) for the mixing model?

For the mixing model, we collected live leaves from three individuals of Ashe juniper, live oak (C_3 species), and dominant C_4 grass species near each trench. The 100% C_4 ($\delta^{13}C_{C4}$) endpoint for grasslands was -16.3 ± 0.8‰, while $\delta^{13}C$ for Ashe juniper and live oak were -26.8 ± 0.4‰ and -28.5 ± 0.5‰, respectively. These values were integral to the mixing model, helping to accurately characterize the contributions of C_3 and C_4 plants to the soil organic matter pool. (L256-257)

L206, I advise caution interpreting how geology and vegetation impact the SIC properties. Untangling SIC complexity likely requires a detailed soil-chronosequence study with specific controls on soil type (topographic position, genetic horizon, carbonates, etc) and the timing of vegetation change.

Thank you for emphasizing the need for cautious interpretation when examining the relationship between geology, vegetation, and SIC properties. We agree that specific controls on soil characteristics and the timing of vegetation change would provide more definitive insights into role of geology on SIC complexities. That’s why we have focused on the potential impacts of vegetation and depth interaction on SIC in our Discussion (L338-344), avoiding an overinterpretation on the role of geology. In addition, we adjusted our manuscript to further align with your recommendation (L372-375):

… release CO_2 from the soil (Ramnarine et al., 2012; Wilsey et al., 2020; Hong and Chen, 2022). We acknowledge that factors such as topographic position and the presence of carbonate-rich horizons may also contribute to complex interactions between soil depth, vegetation, and geology in shaping SIC profiles on Edwards and Buda soils. Our interpretations of SIC profile were based on the assumption that the extent and timing of woody encroachment are consistent across soils stop Edwards and Buda limestones in Edwards Plateau. Given that SIC is among the largest pools in the global carbon cycle…

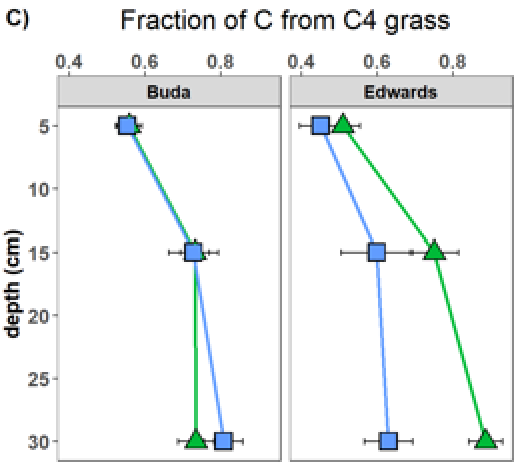
L208, Fig 2d, I wonder if SIC increase is due to the soils being inherently different (Petrocalcic Calciustolls vs Lithic Haplustolls). The Grassland-Edwards site has a considerable amount more SIC than the other sites.

Thank you for this possible explanation. However, both Calciustolls and Haplustolls are commonly observed in soils atop Edwards and Buda limestone formation. For example, Trench 1 located in the Eckrant-Rock outcrop complex, spanning across the Harper (Haplustolls) and Prade (Calciustolls) soil series. Similarly, Trench 5 includes a mix of soil series: Rio Diablo (Haplustolls), Prade, and Ozona

(Calciustolls). This diverse soil composition across our study sites suggests that the variations in SIC are not solely attributable to the binary classification of Calciustolls vs. Haplustolls. Other factors, potentially including microclimate variations, vegetation, or organic matter contributions may also play significant roles in shaping SIC levels in these regions.

Figure 3b, any reason why Edwards-Grass is not part of figure 3b?

Thank you for pointing this out. Because the objective of Fig. 3b is to show the fraction of SOC derived from C4 grass beneath juniper and oak, neither of the Buda nor Edwards graph should include grass vegetation. Here is the correct figure:



L342-344, Yes, but does this generate enough carbonic acid to alter (within the timeline of land type conversion) the petrocalcic horizon? I advise caution interpreting SIC results without knowing the presence/ absence of pedogenic carbon (calcic, petrocalcic) vs geogenic carbon (limestone/ marl).

Both Buda and Edwards soils in Edwards Plateau are rich in carbonates. As you pointed out, the difference in carbonate weathering rates between woodlands and grasslands may not significant under the assumption of consistent water flow partitioning across vegetation types (Wen et al., 2021). However, at soils atop Buda limestone, it has been observed woody encroachment contributed to a 24–44% increase in weathered limestone (Cr horizon) porosity within less than a century (Leite et al., 2023). This change could be attributed to deeper roots facilitating greater infiltration rates, which might enhance bicarbonate exportation and alter the dissolution equilibrium (Leite et al., 2023; Wen et al., 2021).

We have added this into L 368:

The increased infiltration rates due to higher root density may export bicarbonate and further enhance carbonate weathering (Leite et al., 2023; Wen et al., 2021).

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