Response to RC1

We thank the reviewer for their comments. We have provided responses to each comment below. Reviewer comments are in black and author comments are in gray.

The paper by Palmer et al. compiles 101 papers (although the abstract says 100 plus 50?) from the western US to summarize millennial scale (EH, MH, and LH), spatial patterns of climatic, ecologic, pyrogenic, and oceanic changes. Overall, I found the paper interesting and applaud its titanic effort. Summarizing data is not easy. The authors do a good job covering the literature with very few exceptions (see below and attached PDF). The methods are sound, the criteria for inclusion reasonable, and the final spatial and temporal interpretations within the bounds of the available science. Note: as a summary paper, I trust that the interpretations by the authors follow those by the primary authors, so I did not double the cited literature.

We thank the reviewer for their comments.

I provide suggestions/edits/comments below in order of the text, not importance.

1) line 48: under-sampled because of a lack of temperature-sensitive terrestrial records...I think this qualifier should be mentioned. Most WNA records are more water sensitive.

We will add the suggested qualifier.

2) line 57: summer insolation was at a Holocene maximum...winter insolation was at a Holocene minimum. add Kaufmann et al., 2020, and Routson et al., 2019. up-date with Swain et al., 2018; Goss et al., 2020 - specific to W US and CA.

We will add language clarifying insolation following the comment above and we will add the recommended citations.

3) line 85: need to mention Wise's dipole work since it is the dominant feature of interannual hydroclimate in the W US...also, Dettinger and Cayan...also worth adding something about atmospheric rivers in this section since they are THE source of major hydrologic change - feast or famine W US climate.

We will add suggested citations and language around the dipole and atmospheric rivers.

4) line 125 - not sure if this Kirby paper actually deals with plant or animal communities? Maybe Kirby et al. (2018) show a strong coupling between hydroclimate and vegetation over 32,000 years at Lake Elsinore? Or, Dingemans et al. (2014)?

We will add suggested citations.

5) line 141: because of diverse age control issues between and within the 100 comparison sites, you might qualify this first question to reflect millennial-scale patterns since less than millennial is unlikely without significant age control assumptions across sites?

We will update the question to read: what are the millennial-scale patterns and climatic phases during the Holocene for the Western United States? This change also addresses RC1 and RC2 comments regarding age control.

6) Figure 1: I would prefer a labeling scheme for each site so that the reader can go back and forth from the table to the figure to find the sites...e.g., 1, 2, 3, etc.

We will update the labeling convention in Figure 1 to link individual studies to sites on the map.

7) Figure 1: draw the boundaries as defined by your spatial criteria...PNW, SW, etc...

We will add a visual boundary on Figure 1 indicating the regions discussed in the paper.

8) line 163: I think there should be an age control criterion...what is the minimum number of Holocene ages required to make millennial-scale statements??

For inclusion in step two of the review (coded results through time, Figures 2,3), studies must report climate reconstruction for at least "3000 years of the Holocene, and in which the authors must have identified and described a clear climatic pattern or patterns for an entire Holocene interval." [Line 180-183]. Due to the variability in the types of age models used by original authors, we did not elect to require a minimum number of radiocarbon ages or other age types. Rather, as discussed in the methodology and in response to RC1 - 9 below, we maintain the original interpretations of the authors. To ensure clarity of age models from the original papers for readers, we will add two columns to Appendix 1: type of chronology used and number of points in the age model.

9) line 163: are you updating the age models? In many of these types of summary papers, the age models are outdated and likely obsolete. Most review papers begin with fresh age models to make sure that papers published 20 years ago are correctly compared to papers published yesterday.

In this review, we maintain the original interpretations of the authors including both the age models and data interpretations. We attempt to include a diverse set of previously published studies and a variety of proxy types. As such, we maintain the original authors' interpretation of the proxy data as well as the original age model. Our work intentionally utilized the early, mid, and late Holocene as broad time bins to accommodate some age uncertainty and interpreted climate trends on millennial timescales. In our review, we will not recalibrate all age models, but throughout the text we will clarify the role of age uncertainty.

As the variability due to age control was highlighted by both RC1 and RC2 we will make two important changes. We will add statements throughout the paper highlighting the role of age uncertainty in interpretations. Additionally, we will add two columns to Appendix 1: type of chronology used and number of points in the age model. This will clarify the age model data for reviewers and readers.

Further, interpretations from the second step of the review (coded results through time, Figures 2,3) are on millennial timescales, any exceptions to this will be noted in the updated manuscript. Importantly, the sections on the Medieval Climate Anomaly, Little Ice Age, and Era of Colonization are exceptions to our millennial-scale interpretations. We will clarify this in text.

10) line 210: Add Leidelmeijer et al. (2021) - Barley Lake early Holocene.

We will add the suggested citation.

11) line 230-234: in the SW (west of AZ), a wetter early Holocene was a product of more intense winter ppt associated with low winter insolation...the monsoon plays little if any significant role in the annual hydrologic budget west of AZ...see Kirby et al. (2005, 2007, 2012) and (Bird et al., 2010). It is reasonable that the monsoon boost may have "helped" maintain lakes where playas exist today, but without the increase in early Holocene winter ppt caused by lower winter insolation and its likely impact of storm tracks, the SW (west of AZ) would have been dry.

We will rework the section on the role of the monsoon. Per comment 11, 14, and 16, we will include a discussion of the role of winter precipitation in the wet early Holocene. We will remove language that attributes the wet early Holocene to the monsoon alone and we will include discussion of both winter precipitation and the monsoon. We will include some of the existing citations on the monsoon but clarify

that the monsoon rarely reaches west of the Mojave Desert and that the wet Holocene could not have been possible with monsoonal rain alone. We will add suggested citations.

12) Figure 2: add numbers so that the reader can cross-reference sites to the table.
We will update the labeling convention in Figure 1 to link individual studies to sites on the map.

13) line 240: Leidelmeijer et al., 2021 agrees with a dry early Holocene from Nor Cal.
We will add the suggested citation.

14) line 266: see earlier comments...the monsoon provided a hydrologic buffer, but it cannot explain the general increase in moisture...winter ppt must be the answer because the climate of the SW (west of AZ) is unimodal and dominated by winter ppt. All the monsoonal rain in the "world [hyperbole]" could not make the SW (west of AZ) wet without ample winter ppt... enhanced by lower winter insolation and its likely modulation of winter season storm tracks over the SW during the early Holocene.
See response to RC1 #11 above.

15) line 306: add Barber, Donald C., A. Dyke, Claude Hillaire-Marcel, Anne E. Jennings, John T. Andrews, Maclean W. Kerwin, Guy Bilodeau et al. "Forcing of the cold event of 8,200 years ago by catastrophic drainage of Laurentide lakes." *Nature* 400, no. 6742 (1999): 344-348.
We will add the suggested citation.

16) line 415 and elsewhere: I think you are overplaying the significance of the monsoon the CA annual hydrologic budget. CA is characterized by a unimodal hydroclimate in terms of what matters for its annual hydrologic budget...and what matters is simply winter ppt amount and to a lesser extent, summer evaporation.
See response to RC1 #11 above.

17) line 417: most of CA receives no significant monsoonal ppt ever...except Mojave and east (see Hereford, Richard, Robert H. Webb, and Claire I. Longpre. *Precipitation history of the Mojave Desert region, 1893-2001*. No. 117-03. 2004.).
We will add the suggested citation.

18) Section 3.2.5 and other human sections: check out...Grenda, Donn R., and Alex V.Benitez. *Continuity and change: 8,500 years of lacustrine adaptation on the shores of Lake Elsinore*. Statistical Research, 1997.
We will add the suggested citation.

19) line 628: the Late Holocene Dry Period is reserved for the published LHDP by Mensing et al. 2013...I think you misinterpreted Lund and Platzman's data and LHDP age range...at Zaca Lake, ALL 3 papers show an LHDP period between 2500 and 2000 cal yr BP. The MCA is also present as well as the LIA...but nothing comes close in duration or magnitude as the LHDP.
We will update the paper following the reviewer comment on the LHDP.

20) section 3.5: add Crawford, Jeffrey N., Scott A. Mensing, Frank K. Lake, and Susan RH Zimmerman. "Late Holocene fire and vegetation reconstruction from the western Klamath Mountains, California, USA: A multi-disciplinary approach for examining potential human land-use impacts." *The Holocene* 25, no. 8 (2015): 1341-1357.
We will add the suggested citation.

21) line 838: really should consistently point out that the early Holocene was characterized by both higher summer insolation and lower winter insolation...BOTH played a role in the millennial-scale Holocene changes you discuss in this paper.

In all areas when insolation is discussed we will include the role of both the summer and winter insolation.

22) line 862: AND, age control issues!!!, proxy sensitivity issues, and differences in the proxies used from site to site.

We will add a discussion of age control, proxy sensitivity issues, and differences in the proxies used from site to site to this section. Per RC2, we will highlight the importance of age control issues in multiple sections in the paper.

Please also note the supplement to this comment:
https://cp.copernicus.org/preprints/cp-2021-109/cp-2021-109-RC1-supplement.pdf

We will make all line edits included in the RC1 Supplement.