

Thank you for the opportunity to review for *Climate of the Past* the manuscript entitled “Climate impacts on vegetation and fire dynamics since the last deglaciation at Moossee (Switzerland)” by Fabian Rey and coauthors.

The paper presents an interesting contribution to knowledge about the history and development of ecosystems in Swiss Alps for the last 19000 cal yrs BP. The manuscript presents new multiproxy data (pollen, NPP, charcoals) from a small site in north Alps, which in itself is quite important as many of the existing records often only cover the last 17000 yrs cal yrs BP and are more or less well dated. Lake Moossee sequence is well dated and show an exceptional resolution for the Holocene part. In addition, chironomids-inferred temperature of the warmest month based on previous studies (North Italy and Alps) are also plotted in the figures to discuss the links between vegetation changes and climate.

The paper is relatively well written and the figures are necessary (some of them should be improved). Before publication, however, I feel that there are some important issues for the authors to address. These are outlined below.

1. -The scientific questions doesn't appear clearly in your introduction. You write that “Taken together, despite the long tradition of palaeoecological research in Central Europe with quite a high density of well-dated and highly resolved studies, a profound modern assessment of the major vegetation changes and their main causes is currently lacking”: could you be more precise in your state of art? (Which vegetation changes, when and where, which causes, what are the remaining questions?)?

-Your introduction mentions 4 objectives: “(1) to reconstruct the timing of deglaciation and the establishment of first pioneer vegetation around the lake after the LGM, (2) to identify major postglacial changes in ecosystem evolution on the Swiss Plateau and to assess their causes, (3) to discuss the resilience and the vulnerability of Central European lowland forests in the past to inform the near future and (4) to emphasize the utility of exceptional temporal precision and resolution”. These points are important, I strongly agree with you.

However, your discussion needs to be improved to answer more clearly to your 4 objectives. I get the feeling that you're only discussing the first two objectives. Point 3 and 4 are not really discussed. The charcoal analysis and the biodiversity analysis must be discussed in greater detail (the biodiversity results are not included in the discussion, you could also discuss the limits of your PRI and PIE analysis : PIE is the same during the oldest Dryas and the Holocene, but the ecosystems are not comparable). I suggest improving the discussion by around 30% to make it more informative, more precise and attractive to readers. I would encourage the authors to check the text carefully.

2. The text of the manuscript often lacks precision (time periods, climate events, north/south Alps...) and the discussion is not easy to follow. For example, the climatic breaks 1-5 (figs.3,4,5) used to examine the links between vegetation and climate are not identified

and named in the text and the figures. The figure caption only mentions that “The orange horizontal dotted lines (1–5) mark important climatic breaks on the basis of temperature changes (see Finsinger et al., 2019) and/ or changing moisture availability”. I think you mean the Heinrich Event 1, Bolling and Holocene warmings and 8.2 ka. Finsinger et al is a nice paper but not a well reference for climate events and doesn’t explain these events in his text. Please give the appropriate reference to all the climate events that are important during the late glacial and the Holocene, make them appear more clearly on the figures, and discuss them: Younger dryas (doesn’t appear on the figure, why?), Preboreal oscillation, 4.2 ka and so on are missing. The timing of the Heinrich event 1 and of each event must be discussed (remember you submit this manuscript to Climate of the Past). It’s an important point because you state that these important “climate breaks” (please avoid this term and give the right terminology, see the NorthGrip one) cause changes on the vegetation at Mossee “these vegetation shifts were released by climate changes at 19,000, 16,000, 14,700, 11,700 and 8200 cal BP”. **For me it’s not very clear on the figures and several of the discussion/conclusions are not supported by the results.** Before writing that “This climate synopsis allows for the first time a tentative regional assessment and discussion of climate amplitude variation and its impacts on vegetation for the past 19,000 years” p 6, the climate patterns should be better integrated with the pollen data and discussed in greater detail with consideration of trends and major events on the vegetation at a regional scale (see point3).

3. A regional synthesis of key pollen diagrams from north and south Alps is lacking to further understand and identify major postglacial changes in ecosystem evolution on the Swiss Plateau and to assess their causes (objective2). Only the pollen record from Lago di Origlio is plotted for comparison in fig. 4. It’s not enough. More pollen diagrams (see table 2) are available and needed to answer to your objective and to discuss the vegetation-changes relationships at a more regional scale (for example, to discuss the possible time lag between north and south). I recommend to add also the exceptional sequence from Lake Bergsee (Duprat-Oualid et al., 2017 in your new figure).
4. The Holocene part of your pollen diagram (and biodiversity study) has already been published in Journal of Ecology (Rey et al., 2017). It’s not mentioned in the introduction and not really discussed in the text. The authors need to clearly show what this new study brings in terms of results compared to the study of Rey et al (2017).
5. Abstract should be more informative: what are the conclusions about charcoals and fires during the Lateglacial?? What about the biodiversity analysis?
6. The discussion on the age-model is too short. Do you accept all the 62 dates? What is the temporal resolution for the Lateglacial part? What about the large uncertainties between 18000 and 14000 yrs BP?

7. Sofular cave isotope curve can be removed (not discussed) from the figure 5. Better replace it by speleothems-inferred climate signal (Alps or north Italy).
8. The references cited in this paper seems “lab or team centered”. Could you add more key references to open the discussion (see Blaga et al., 2013 for biomarkers, Magny et al for Lake Lautrey, Brisset et al., 2015, Di Rita et al 2018 for millennial scale changes during Holocene)? Key references for the LGM, Lateglacial and Holocene climate patterns and timing are lacking: replace Finsinger et al 2019 cited everywhere by the right references relative to each climate event.
9. Minor points:
  - a. P. 2, line 50: “Similarly, well-dated pollen profiles from Western and Central Europe covering the first two millennia of the Oldest Dryas (ca. 19,000–17,000 cal BP) are almost absent and the existing chronologies are therefore inadequate (e.g. Woillard, 1978; Welten, 1982; Ammann and Tobolski, 1983; de Beaulieu and Reille, 1984; de Beaulieu and Reille, 1992).” This sentence needs to be corrected: for example, the Lake Bergsee pollen sequence covers this time period and is well dated; moreover, if the French long sequences are not very well dated (I agree with you), they cannot be neglected as they bring valuable information on past vegetation changes for this time period.
  - b. P2, line56: “the main cause has been identified as the post HE1 warming”: what do you mean by post HE1 warming? More precision are needed: timing, local or global signal?... Is it found in other papers than Samartin et al? marine cores?
  - c. There are numerous occasions where the authors write in the text (see reference...), just writing the reference is enough; you can also remove the lab number for dates/analysis in the text.
  - d. P 7, Younger dryas: “the dominance of *Pinus sylvestris*-type and the decrease of *Betula* pollen after 12,900 cal BP, followed by an increase of herb pollen ( $\leq 20\%$ , see Poaceae, *Artemisia*) and *Juniperus* pollen (2–3 %), points to a transformation of closed mixed boreal forests into more open, pine-dominated parklands. We interpret this change as a consequence of climate cooling during the Younger Dryas”: these changes are not clear on the pollen diagram. Better to include the YD in the Fig 4 to better seen the changes.

I realize the authors may find my comments difficult to approach, but I sincerely hope they accept them as well-intentioned guidance. It should not be difficult to address them. Once concerns are addressed, I feel the manuscript will be much closer to being an outstanding contribution to knowledge in this poorly understood time period.