

## ***Interactive comment on “Past, present and future biomes in Beringia: Comparison between simulations and pollen analysis” by Kazuyuki Saito et al.***

### **Anonymous Referee #1**

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Review of:

Past, present and future biomes in Beringia: Comparison between simulations and pollen analysis

By Kazuyuki Saito et al.

This manuscript describes a study on vegetation change in the region between Alaska and northeastern-most Siberia. Using the BIOME4 global vegetation model and driven by climate data from GCMs, the authors performed a series of simulations at key periods in recent earth history and into the future. For simulations at 21ka, 6ka, and the late preindustrial Holocene, the authors compare modeled vegetation composition in

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the form of biomes to reconstructed biomes at individual sites based on pollen recovered in sediments. The results show large changes in simulated vegetation between the different periods studied, and particularly at the LGM, large disagreement among the vegetation model results depending on the GCM output used to drive the vegetation model. Comparison between the modeled vegetation and the pollen-based reconstructions is likewise better for the Holocene simulations than for the LGM. This study could potentially be interesting as it focuses on a part of the world where a large amount of paleoenvironmental data exists, and where future climate change is expected to be large.

Unfortunately, the study provides little in terms of new information, methodology, or results following two very similar studies (Kaplan et al., 2003; Kaplan and New, 2006). In several ways, the current study is even worse than previous work, particularly in terms of the spatial resolution of the vegetation model simulations and the baseline climate datasets that were used to drive the model, and the way the paleoclimate scenarios used to drive the vegetation model were constructed. To the study's credit, it does use new data for the pollen-based vegetation reconstructions, and a more recent generation of GCM output for the paleoclimate and future climate simulations compared to work that was done more than a decade ago. On the other hand, it appears that the future climate simulation was not performed in a way that is appropriate for an equilibrium vegetation model. To advance the science and make this study suitable for publication in a peer-reviewed journal, the following steps would have to be taken at minimum:

1. Improve the overall methodological design of the study, with an aim at addressing a specific research question or hypothesis. Any indication of intentional hypothesis testing is absent from the current manuscript.
2. Run the model at a higher spatial resolution, with a minimum of the 10km used by Kaplan and New 2006.
3. Use better baseline climate data as input, such as PRISM, which solves the problem

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of forest on the North Slope of Alaska (also noted in Kaplan and New, 2006).

4. Provide a quantitative comparison, at the gridcell level, between modeled vegetation and the pollen-based vegetation reconstruction. Provide deeper explanation of why there is a model-data mismatch.

5. Generate some recommendations for improving models of large-scale vegetation patterns in Arctic environments in the future.

6. Comment more substantially on the potential future vegetation of Beringia, and how long it might take before the modeled patterns to be realized.

Finally, the manuscript is not written clearly and needs substantial copyediting. For these reasons, I cannot recommend this manuscript for final publication in *Climate of the Past*. In the attached PDF, I provide a number of specific comments and suggestions that could be employed when preparing a new manuscript.

#### References

Kaplan, J. O., Bigelow, N. H., Prentice, I. C., Harrison, S. P., Bartlein, P. J., Christensen, T. R., Cramer, W., Matveyeva, N. V., McGuire, A. D., Murray, D. F., Razzhivin, V. Y., Smith, B., Walker, D. A., Anderson, P. M., Andreev, A. A., Brubaker, L. B., Edwards, M. E., and Lozhkin, A. V.: Climate change and Arctic ecosystems: 2. Modeling, paleodata-model comparisons, and future projections, *J Geophys Res-Atmos*, 108, 2003. <https://doi.org/10.1029/2002jd002559>.

Kaplan, J. O. and New, M.: Arctic climate change with a 2 degrees C global warming: Timing, climate patterns and vegetation change, *Climatic Change*, 79, 213-241, 2006. <https://doi.org/10.1007/s10584-006-9113-7>.

Please also note the supplement to this comment:

<https://www.clim-past-discuss.net/cp-2018-29/cp-2018-29-RC1-supplement.pdf>

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Interactive comment on *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2018-29>, 2018.

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