

Interactive comment on “Vegetation responses to interglacial warming in the Arctic, examples from Lake El’gygytgyn, northeast Siberia” by A. V. Lozhkin and P. M. Anderson

Anonymous Referee #1

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review of "Vegetation responses to interglacial warming in the Arctic, examples from Lake El’gygytgyn, northeast Siberia"

General comments This is a well presented paper describing some fascinating results. Arctic vegetation response to climatologically variable interglaciations as revealed by the Lake E core promises to reveal much about climate-vegetation interactions and the nature of past interglaciations. I do not have substantive criticisms of the manuscript but I do have a few ideas to add to those presented here. I look forward to further results! At the very end of the review are a few minor points of clarification/typos.

Substantive comments relating to discussion

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259/3 The variability in vegetation response et seq – I wonder if this argument doesn't require slightly reorienting? Even if the glacial vegetation was homogeneous, it still exerted significant feedback effects on the climate. However, the interglacial vegetation was heterogeneous AMONG interglaciations) and thus exerted a variable feedback effect in different interglaciations. Also, because of the greater PFT variation available to constitute vegetation WITHIN interglacials, climate may have varied enough WITHIN interglacials to affect feedback within a given interglacial period. This set of possibilities might usefully be expanded upon.

Role of moisture. This is mentioned quite a lot in the part of the paper where the potential modern vegetation analogues and their respective climates are discussed, but it does not figure prominently in the discussion. Kaplan et al modelled Picea across east Siberia with increasing winter snow and milder winters (for the future). Picea (and P. pumila) indicates some level of winter warmth and/or moisture. Variation in effective moisture resulting from the interaction of key climate forcing factors may play a role in defining the dominant PFTs in interglacial vegetation irrespective of what temperatures were reached in the growing season (as long as they were over the critical threshold for the species)

Richard West's (1980) classic study of the British interglacial record (which showed a different sequence and combination of woody taxa in each studied interglaciation) led him to muse upon some of the same points as you discuss here. He contrasted a climate-dominated process with the ecological/ biogeographical properties of taxa (migration rate, location of "refugia", etc) as mechanisms that would allow them to arrive early, late, or not at all in a given interglaciation. While delayed/prevented migration is not fashionable, it may well still happen. In recent years the scales have tipped rather towards climatic determinism and away from ecological and evolutionary constraints. The kinds of distances you are dealing with here merit a look at these biogeographical processes (as you mention in the paper, but maybe could develop more).

This raises the issue of the nature of cold stages and their influence on woody taxa

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survival and biogeography. MIS 31 is way back before the pre-400 ky cyclicality shift to "deep" glacials. What then, might have happened to the north temperate taxa (e.g. *Corylus*) in these early cold phases? One might imagine that their ranges shifted less dramatically than they did in recent cold stages. In such a case, given enough warming and enough time, such taxa would stand a chance of regaining quite northern distributions in really warm interglacials. If however, they are were too far away, then they never made it back.

Additionally, going back to MIS 31 also raises the possibility of Quaternary extinctions. It is possible (I don't know how likely) that other species of *Corylus*, for example, occurred in northern Eurasia in the early Pleistocene. Watts's (1988) account of the extinction of about half the European tree flora through the Pleistocene may have parallels in northern Eurasia, about which we know rather little (although Lake E promises to tell us a lot more).

Watts, W.A. 1988. Europe. pp 155-192. In B. Huntley and T. Webb III (Eds). *Vegetation History*. Kluwer. Dordrecht West, R. G. 1980. Pleistocene forest history in East Anglia. *New Phytologist* 85, 571-622

Minor technical points Abstract: given that the studied intervals extend from the Holocene to MIS 31, it might be good to very briefly explain why the particular stages mentioned here are the focus of the paper – ie, what is the total extent of the E record and why is the remote stage 31 compared with 1, 5, and 11, which are more typically studied in long records? ... OK this answered in intro, but can you squeeze something in to the abs as well?

247/10 contrast with? 248/4 PG1352 and D1—can these be referenced somehow? 248/13 we do not separate 249/7 is vegetation barren? Is sparse a better word? 249/16 climatic values are as follows: 249/20 temperatures;(comma?) 250/7 Reference for this statement or further information on what set of analogues used? Analog analysis also

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indicates warm January temperatures and increased July precipitation as compared to modern. These conclusions are based on “possible pollen analogs” to southern Beringia shrub tundra. 251/5 can you standardize the punctuation in this complex list? (Anadyr basin; Fig. 5 1), to Larix forest with tree Betula, tree Alnus, and Pinus pumila (northern Chukotka, upper Kolyma and Indigirka basins; Yana-Indigirka-Kolyma Lowland) to Larix forest with Picea (upper Kolyma and Indigirka basins; northern Lowlands; northern Okhotsk sea coast). 253/4 Fix? ..Rivers, which ARE located 5 150 km to the east of Magadan (Fig. 1). This vegetation is thought to be a relict forest from a previous warm interval (Rheutt, 1970). 253/10 20+ m fix superscript in text 254/7 Possibly simplify?....forest either became sufficiently open to allow for the establishment of Pinus shrubs in the understory and/or the shrubs formed a mid-elevation shrub zone beyond altitudinal treeline. 254/25 "Possibly" not needed 254/27 estimated to have been? 255/1 drier cool-seasons - hyphen not needed 255/4 by a sharp decrease? 256/12 Chukotka compared with today?

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