Climate of the Past Discussions

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Comment on cp-2021-125

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Community comment on "Holocene wildfire regimes in western Siberia: interaction between peatland moisture conditions and the composition of plant functional types" by Angelica Feurdean et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-125-CC1, 2021

General comments

Angelica Feurdean's article is a complete, multi-proxy study that is extremely important and interesting for understanding the history of the boreal forests of southeastern Western Siberia. The article is the result of the work of a large team over several years. For the most part, the article is already ready for publication; it is also of interest to Russian scientists engaged in related research in the south of Western Siberia. However, before publishing the article, I would recommend making some changes, both in the logic of the interpretation of the results, and making minor technical changes.
https://disk.yandex.ru/d/8XbeP1vRk_y4lQ

- *Populus tremula* is a tree species that does not leave traces in the spore-pollen spectrum. However, this species is abundant in the taiga of the Tomsk Region, which is clearly visible on the map: https://disk.yandex.ru/d/8XbeP1vRk_y4lQ (osina, green). If the community of dark coniferous species is destroyed (as a result of fire or insect infestation), they are replaced by birch, aspen or pine. Aspen can form large monodominant forests. Moreover, the existence of such communities can reach several hundred years if the rudiments of dark conifers do not come from outside. Moreover, if there are no dark conifers, then gradually aspen forests can replace birch and pine forests (Pinus sylvestris). That is, aspen forests can have a significant impact on the proportion of birch and pine pollen. This is worth mentioning in the discussion.
- In determining the fire regime, an important role is played by how close the swamp is located to the mineral bank. Fire usually enters the swamp from the mineral shore. Also, the presence of a cover of sphagnum mosses affects the possibility of fire spread. The latter severely limit the possibility of bog burnout. Based on Figures S3b and Figure 4, it can be seen that the sphagnum mosses appeared on Rybnaya about 3600 years ago, after which the peat fires disappeared. The sampling point itself is quite distant from the mineral shore of the bog, a couple of kilometers (excluding isolated mineral forest islands). This further reduces the likelihood of a peat fire on Rybnaya. The Ulukh-Chayakh point is located just 160 meters from the mineral shore, sphagnums began to play a role only in the last centuries due to the large fires of the Russian time. As a result, peat fires occurred on Ulukh-Chayakh until recently (less than 500 years). These differences between the sites under consideration should be reflected in the discussion.

A good example of how the number of fires decreases with distance from a mineral shore, is the data from the article: Turunen J., Tahvanainen T., Tolonen K., Pitkänen A. Carbon accumulation in West Siberian mires, Russia // Global Biogeochemical Cycles. V. 15 (2). P. 285–296. DOI: 10.1029/2000GB001312 Note that in the last article, the sources of fires are anthropogenic. Today it is known that the Neolithic Settlement of Kayukova-2 is located there. Note that the peaks of fires on Rybnaya correlate with the heyday of the Neolithic (7-5.5 years ago) and Eneolithic (5-4 thousand years ago) cultures. At UC, there are correlations with cultures from the Bronze Age and the Middle Ages. However, there are no publications with reliable radiocarbon dates, so this is still only a hypothesis.

- On Rybnaya, most likely, there has been no peat fire for the last 4.5 thousand years. On Ulukh-Chayakh, they continued until recently. Obviously, a fire in a swamp is not only a factor in changing the vegetation cover, but also strongly transforms hydrological parameters. Obviously, bog fires could also affect the level of bog water, in case of damage to the stand, or the introduction of other plant species. This point seems to me important and, at least, it makes sense to mention the possibility of such an effect.
- The disadvantage of this work is that the results of work on this topic, which were carried out by scientists from Russia and Tomsk, are not reflected in any way. Many are in Russian, but Russian co-authors could help translate these articles. I recommend correlating the results obtained with the following articles:

(Blyakharchuk et al., 2003): doi: 10.1191/0959683603hl658rp

(Borisova et al., 2011): doi: 10.1016/j.quaint.2011.01.015

(Willis et al., 2015): doi:10.1177/0959683615585833

(Kurina, Blyakharchuk, 2020): doi:10.1088/1755-1315/611/1/012025

(Willis et al., 2015): doi:10.1177/0959683615585833

(Krivonogov et al., 2012): doi:10.1016/j.palaeo.2012.02.030

(Blyakharchuk et al., 2019): doi:10.17223/19988591/45/9

(Blyakharchuk et al., 2018): doi:10.17223/19988591/42/12

Specific comments

Abstract:

Line 40: It is better to use deciduous forests instead of “broadleaf forest”. In Siberia, there are practically no broad-leaved species, except for small areas of linden, as well as plantings in cities.

Lines 44-48: It is necessary to reformulate these results. So we are talking about the intervals between 7.5-4.5 ka BP and later.

Line 95: Articles “Rudaya et al., 2020” on the steppes. You can also add the following article to this paragraph: Lamentowicz, M., Słowiński, M., Marcisz, K., Zielińska, M., Kaliszan, K., Lapshina, E., Gilbert, D., Buttler, A., Fiałkiewicz-Kozieł, B., Jassey, V.E.J., Laggoun-Defarge, F., Kołaczek, P. Hydrological dynamics and fire history of the last 1300years in western Siberia reconstructed from a high-resolution, ombrotrophic peat archive (2015) Quaternary Research (United States), 84 (3), pp. 312-325. DOI: 10.1016/j.yqres.2015.09.002

Line 105: What is the Subarctic Climate Impact? This is the first time I hear about it. This can be said about any boreal region, so it is better to remove it. You can also replace "continental climate" with "continental boreal climate"

Line 108: Light and dark taiga are copyright terms, you need to indicate it here. Populus tremula is also included in the light taiga.

Line 107-109: This information is not available in the cited sources (Berezin et al., 2014; Rybina et al., 2014). Although there is practically nothing to find in English, there is a lot of good research in Russian. The following article by N.N. Lashchinsky with a large English abstract: https://elibrary.ru/item.asp?id=24116649

Line 115: How did you know that birches are young? Was their age determined? Maybe they are just short, dwarf? Wasn't *Pinus sylvestris* there?

Line 219 and further: How was forest density determined? The fact of the prevalence of "light taiga" in the vegetation cover of plant communities does not mean that the forest was of low density (low projective cover?). Birch or aspen forests can have a fairly high crown density, forming a high density forest. It is necessary to clarify this term and its calculation.

Line 255: During riding fires in Siberia, standing tree trunks, as a rule, only burn. Usually, after a fire, standing burnt trunks remain, which then can fall for several decades. Crowns, bark, litter and trunks that have previously fallen to the ground burn and burn completely.

Lines 331-335: After the appearance of sphagnum on Rybnaya, the mire became more watered. That is why it could burn less, since after the appearance of sphagnum, based on figure S3b, there are no more large charcoals here. On Ulikh-Chayakh, this is not observed and fires continued to enter this mire from the mineral shore.

Line 346: Is peatland moisture primary? Maybe the humidity of the climate is primary? Do you interpret peat moisture in terms of climate moisture? Or do you think that this is only a consequence of changes in hydrology associated with the self-development of the peatland? In my opinion, both are captured in the water level curve.

Line 350: I am not aware of any cases of *B. pendula* growing on peat soils in the Tomsk region.

Lines 375-376: Check the correctness of the quotation. I saw that in an article by Kharuk et al. (2021) says the opposite, for example: "It is expected that more frequent and severe fires will promote substitution of the DNC within their southern range by broadleaf (birch and aspen) and drought-resistant larch and Scots pine species".

Line 381: *Calluna vulgaris* does not grow in the studied region. Heatherland is also not typical for the south of the Tomsk region. In the southern taiga, forests are herbal. Species of the Ericaceae family have large coverage on (1) sandy mineral soils; (2) in the peatlands. In the forests adjacent to the Rybnaya site, sandy soils, on Ulukh-Chayakh loamy. The contribution of ericoid pollen from forests on sandy soils near Rybnaya should be small, due to the remoteness of the bog from the sand dunes. For the Ulukh-Chayakh site, ericoid shrubs are typical for bogs, since forbs prevail on the nearby mineral island. In this regard, we can say that the appearance of ericoid pollen is mainly associated with the evolution of bogs. On Rybnaya, ericoids appeared after 4500 ka, and oligotrophization began. Then the content of ericoid pollen decreased, as the invasion of sphagnum mosses took place, which reduced the coverage of ericoids.

FigS5 and Lines 321-322: There are two oddities in the distribution of Ti over the Rybnaya

peat deposit. The first is the increased concentration of titanium in a layer about 50 cm thick from the base of the peat deposit. The second oddity is the lower Ti concentration at the bottom of the peat deposit, compared to the overlying 50 cm layer. Also, in Table S1 and Figure S1, date inversion is noticeable. In my opinion, this is a consequence of either the windblown tree, or the action of the stream, now buried under the peat. This can be mentioned in the interpretation.

Further, we note that the Ti peak in the UC sequence between 4 and 3 ka approximately corresponds to an inversion of the C14 age at a depth of 185 cm (Rosaceae seeds); perhaps this is not an accidental coincidence. It is likely that this is the influence of a powerful flood in Chulym, which flooded the first terrace above the floodplain, on which mire UC is located. There are indications of powerful floods in the period 4-3 ka in Russian-language literature (for example, Leshchinskiy, S. V., et al. "The first terrace above the Ob'floodplain near Kolpashevo: the age and formation conditions." Russian Geology and Geophysics 52.6 (2011): 641-649).

Technical corrections

Figure 1: Site Ulukh-Chayakh on the map is marked between deciduous forest and mire. But in fact, on the left, there is a mineral shore, on which there is an abandoned arable land. It is necessary to correct the contours on the map, since this contact, in my opinion, is important for the interpretation of the data.

Lines 19-21: Fix affiliations. Affiliation errors number 7 and 9.

Line 37: "… near Tomsk Oblast, Russia" replace with "… from Tomsk Oblast, Russia".

Linu 112: In degrees, correct the commas for periods.

Line 114: About 30-40 km to the border.

Line 166: Missing reference to Gill, 1981.