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Interactive comment on "Arctic aquatic graminoid tundra responses to nutrient availability" *by* Christian G. Andresen and Vanessa L. Lougheed

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General Comments

This work represents an important biogeochemical study that complements our knowledge of the impact of soil fertility and lake environment on the productivity of aquatic plants in the cold Arctic climate using the example of the Barrow Peninsula, Alaska.

Specific Comments

Introduction Line 37-41: Note that, in addition to the listed cases of increase in vegetation productivity, there are many other illustrative of higher productivity of vegetation, relative to the background, within the basins of drained thermokarst lakes (Loiko et al., 2020, doi: 10.3390/plants9070867), dried up bottoms due to catastrophic events and

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Discussion paper

warm years (Nitz et al., 2020, doi: 10.5194/tc-14-4279-2020), as well as in places of activation of landslide and thermokarst processes on the slopes (Khitun et al., 2015 in Fennia - International Journal of Geography; Ukraintseva et al., 2014 in Landslides in Cold Regions in the Context of Climate Change), and sites of thawing of ground ice (Becker et al., 2016, doi: 10.1111/1365-2745.12491). The productivity of the vegetation of the listed places is high due to the higher fertility of the soils. Line 70-74: Note that there is recent information about a new unaccounted for a nutrient source that is concentrated under the active layer in the ice. These recent data make clear the reasons for the increase in productivity with increasing active layer thickness (References: Lim et al., 2020, doi: 10.1016/j.chemosphere.2020.128953 ; Subedi et al., 2020, doi: 10.5194/tc-14-4341-2020 ; Fouché et al., 2020, doi: 10.1038/s41467-020-18331-w).

Methods In this section of the article, it is also worth giving a brief description of the soils (mineral, organogenic, peat thickness). Line 150-151: At what distance from each other were the collected individual plants of the two studied species? In fact, even on a nanoscale horizontal scale, the properties of soils and sediments can change noticeably. Therefore, if the soil is not selected exactly in the place where the plant grew, then the correlation will be weaker. It is better to clarify this fact for a better understanding of the article by readers. Line 160-162: Clarify the sampling depth. Did you sample to a depth of 10-20 cm, that is, in the ranges 0-10 or 0-20? Or did you collect the horizon from 10 to 20 cm? This is important since the distribution of nutrients is highly heterogeneous in depth. The maximum concentration always falls within the 0-5 or 0-10 cm layer. However, the supply of labile forms of elements strongly depends on the soil density, which in turn depends on the type of substrate (mineral or organogenic). Line 169-170: The article indicates that the biomass was taken into account for each plant species, and not for the entire plant community. This means that in communities with several dominant species, the biomass of a particular plant species depended not only on soil fertility but also on the biomass of other plant species. Therefore, the question arises, were all communities monospecific? If there were communities of several plant species, it would be correct to normalize the biomass

to the cover (proportion of the species) of the measured species for which the biomass was measured.

Results For this section, one can calculate the ratio of nitrogen to phosphorus in the biomass of the studied plants (according to Wassen et al., doi: 10.1038/nature03950). This interesting indicator shows which of the elements limits the formation of above-ground biomass, phosphorus or nitrogen.

Discussion To Jones et al., 2012 (doi: 10.1029/2011JG001766) and Loiko et al., 2020 (doi: 10.3390/plants9070867) show that NDVI is affected by the thickness of the peat. Have you measured the thickness of the peat? Could the litter or peat have affected the biomass of plants, their projective cover and NDVI?

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