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Biogeosciences Discussions

Interactive comment on "What are the main climate drivers for shrub growth in Northeastern Siberian tundra?" *by* D. Blok et al.

Anonymous Referee #1

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General scope:

The authors present shrub ring chronologies of two species with markedly different growth forms that have not been used in dendrochronology before and from an area where (to my knowledge) no single study on shrub growth has been performed before. The authors further relate the shrub ring chronologies to climate (temperature and precipitation) and NDVI data and present the remarkable finding, that for both shrubs independently of their growth form, early summer temperatures are of highest importance for shrub radial growth. Similar findings have been published from coniferous shrubs in Northern Scandinavia (Hallinger et al. 2010, Hallinger & Wilmking 2011) and deciduous shrubs from West Siberia (Forbes et al. 2010). The present study does not only fill a spatial gap concerning the growth assessment of shrubs around the arctic

but also confirms the highly disputed findings of the other studies that summer temperature is indeed in more than a few species and study areas the driving force behind enhanced shrub growth.

Thus, the paper addresses relevant scientific questions within the scope of BG and the criterion of novelty is fulfilled, at least concerning the data (species not yet/rarely used for dendrochronology and from an area so far not covered by dendrochronological investigation on shrubs). The scientific methods are valid and clearly outlined, the overall presentation is quite well structured and clear.

Except for one, all interpretations are supported by the results presented here (see details below). The whole supplementary material should be deleted as it only repeats the four tables anyway presented in the main document.

I have reviewed an earlier version of this paper. Since then, the authors have made major improvements, especially concerning the discussion and the relationship between the results and the nature of conclusions that are supported by them.

Details:

Lines 11-13, 21-23, 18-20: “However, little is known about long-term. . .” this statement is repeated in almost identical ways three times and then finally stated in the aim section at the end of the discussion (number four). This is an indication that the introduction could and should be improved concerning the organizational structure. I would advise to restructure the introduction and not to jump from “climate change scenarios” to “evidence for shrub expansion” and then back to “summer air temperature”. The authors should concentrate the climate issues in one paragraph and the evidence for shrub expansion in another paragraph rendering repetitions unnecessary.

Lines 26-29: “ring width measurements were calculated from measurements taken from samples of two heights” Does that mean that 4 radii were averaged into an individual shrub ring width curve? Generally, I would advise to be careful with the averag-

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ing of different numbers of radii into growth curves because of the possibly distorting effects of this procedure on chronology variance.

Lines 11-13: This conclusion is not supported by your results! The non-existing correlation of the shrub chronologies with winter precipitation does not indicate anything. Why? You give the answer in line 14: winter precipitation is indeed only one of several parameters affecting local snow height and without on the ground snow depth and duration measurements over at least a couple of snow seasons I would not dare to conclude anything from a lack of correlation with snow precipitation data that is a) very hard to measure in the windy arctic conditions and b) can be substantially erroneous (Benson, 1982; Goodison, 1978; Golubev, 1985; Yang et al. 2005).

Benson, C. S., 1982: Reassessment of winter precipitation on Alaska's Arctic Slope and measurements on the flux of wind blown snow. Geophysical Institute-University of Alaska Report UAG R-288. Fairbanks, Alaska. 26 pp.Report UAG R-288.

Forbes B, Fauria M, Zetterberg P. 2010. Russian Arctic warming and greening are closely tracked by tundra shrub willows. Global Change Biology 16: 1542–1554.

Goodison, B. E., 1978: Accuracy of Canadian snow gauge measurements. J. Appl. Meteorology, 27, 1542-1548.

Golubev, V. S., 1985: On the problem of actual precipitation measurements at the observation site. Proceedings of International Workshop on the Correction of Precipitation Measurements, WMO/TD-104, Geneva, World Meteorological Organization, 61-64.

Hallinger M, Manthey M, Wilmking M. 2010. Establishing a missing link: warm summers and winter snow cover promote shrub expansion into alpine tundra in Scandinavia. New Phytologist 186: 890-899.

Hallinger M, Wilmking M. 2011. No change without a cause – why climate change remains the most plausible reason for shrub growth dynamics in Scandinavia. New

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Phytologist 189: 902-908.

Yang, D., D. Kane, Z. Zhang, D. Legates, and B. Goodison, 2005: Bias corrections of long-term (1973-2004) daily precipitation data over the northern regions. Geophys. Res. Lett., 32, doi:10.1029/2005GL024057.

Interactive comment on Biogeosciences Discuss., 8, 771, 2011.