

EGU2020-10316

<https://doi.org/10.5194/egusphere-egu2020-10316>

EGU General Assembly 2020

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## Recent and future productivity of Russian forests under climate change

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Knowledge of dynamics of forest productivity, expressed in terms of Growing Stock Volume (GSV), Net Primary Production (NPP), such derivatives like current increments (net and gross growth), is crucial for understanding the impacts of forest ecosystems on the major global biogeochemical cycles and eventually – on the Earth climate system. This knowledge is not satisfactory in Russia currently (the country's forests cover >20% of the global forest area) because 1) data of official forest inventory are obsolete and substantially biased due to the fact that about 50% of Russian forests were inventoried more than 30 years ago; 2) of the above indicators, Russian forest inventory directly defines only GSV, but by the methods, which have substantial systematic errors of unknown size; 3) remote sensing methods themselves still cannot reliably provide some necessary details, like species composition, age and age structure of stands, below ground live biomass etc. In this presentation, we attempted to provide a systematic reanalysis of the estimates of the above indicators. To this end, a special system was developed to update the data of forest inventory for periods after the latest inventory by forest enterprises (about 1700) based on all available ground-based information and a multi-sensor concept of remote sensing. Hybrid forest cover was presented as an aggregation of 12 satellite products at spatial resolution of 150m. The updating of the main biometric indicators of Russian forests was based on the models of the growth and bioproductivity of modal stands. The results of the actualization have showed substantial overestimation of areas by official inventory and underestimation (up to 20%) of GSV. Comparison of obtained results with an independent assessment of the dynamics of areas and GSV, which was made by the Space Research Institute of the Russian Academy of Sciences for the period 2000-2017, showed a high level of compatibility. Using the results of actualization, live biomass was assessed based on a new system of conversion coefficients (Schepaschenko et al. 2018), NPP - on a method described in Shvidenko et al. (2007); and current increments – using a regionally distributed modelling system on increment dynamics of modal stands. Climate were analyzed for 3 periods: "historical" (1948-1975), "current"(1975-2017) and "future" (using all 4 scenarios RCP (2020-2100)). NPP and increments were estimated for the two last periods using a model, which takes into account selected climatic indicators and fertilization effect of enhanced CO<sub>2</sub> concentration. It is shown that use of the obtained results presents substantial possibility for improvement of estimates of the carbon budget of Russian forests, particularly those received by

inventory methods, and eliminate the existing discrepancies in estimates of the carbon budget of Russian forests reported in different publications. Projections for future suppose that significant part of Russian forests under "critical" scenarios (RCP6.0 and RCP 8.5) have a high probability to reach the tipping point by end of this century.