Policy Brief

Russian forests and climate change: status, impacts, vulnerability and adaptation needs

Key messages

- Currently, Russian forests represent a large overall carbon sink, but large areas in the Northern and Eastern parts of Russia act as a carbon source. Future natural disturbance impacts are critical: further increased wildfire disturbances with subsequently increased tree mortality may lead to a substantial decrease of the Russian forest carbon sink.
- High attention should be directed to disturbance prevention and enhanced forest resilience. Climate change impacts will put the current forest sector severely at risk. Active adaptive forest management is needed to reach the Paris Agreement targets.
- Due to the recent and projected future large-scale natural disturbances, crucial focus is necessary on large scale forest restoration and reforestation, which requires active support.
- Implementation of the research results in practice remains a challenge, and successful utilization of forest resources in the future critically depends on the evolution of forest governance as well as improved national forest inventory and forest monitoring with integration of modern ground-based measurement methods and remote sensing capabilities.

Russian forests are globally important

Russia has almost 800 mill. ha of forests, which are globally important in terms of forest area, carbon stock, their influence on global climate and their potential as a renewable resource.

Russian forests also play a key role in biodiversity preservation and offer diverse ecosystem services, which are vitally important for society both nationally and globally. The gigantic scale of Russian forests causes significant challenges with large sparsely populated remote areas and lacking infrastructure. Harvest usage has been much higher in densely populated regions. Due to an extensive exploitative model of forest use, the quality of forest resources has been degrading in many regions with undesirable changes of species composition and decreasing area of exploitable forests.

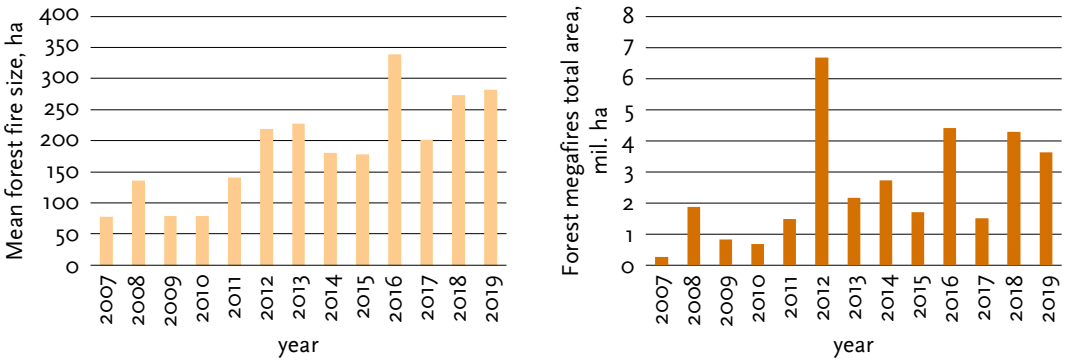
Forest disturbances pose a critical threat to Russian forests, damaging 10–15 mill. ha of forests annually. Climate change may further exacerbate drought induced forest decline and intensify natural disturbances, such as wildfire and insect outbreaks. These challenges should be assessed by a systematic analysis of the Russian Federation's forest resources, their potential for carbon sequestration and contribution to the Paris Agreement targets, paying particular attention to climate change vulnerabilities and adaptation needs.

Russian forests were a significant net carbon sink during the last decades, with high temporal and spatial variability mainly caused by interannual variability of seasonal weather and natural disturbances. Despite the average sink, there are vast areas, mostly in disturbed forests and on permafrost, which temporarily act as a carbon source. In the 21st century, carbon sink dynamics in Russian forests had no statistically significant trend until 2017. However, exceptionally high level of disturbances in 2018 to 2020 will likely result in a substantial decrease of the Russian forest carbon sink.

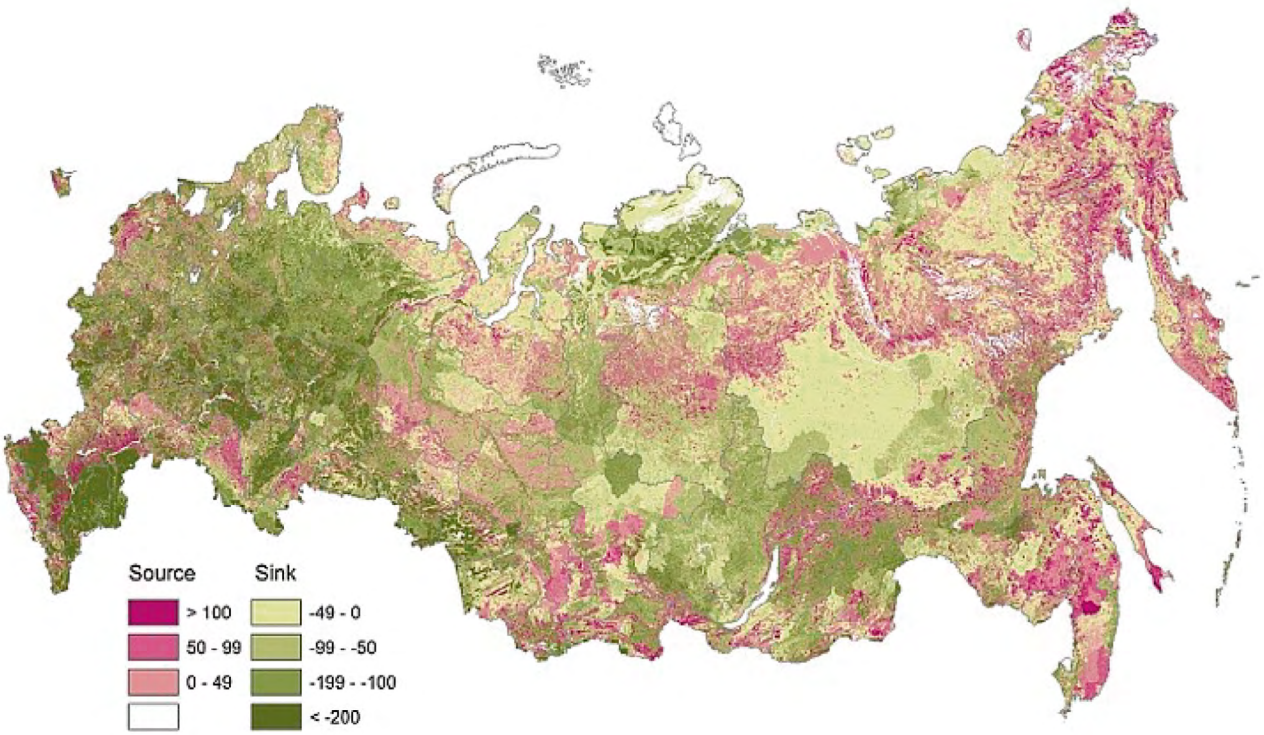
Climate change in Russia

Climate change is already affecting Russian forests in diverse ways. Over the past 40 years, there has been a general climate warming trend at about 2.5 times the global average increase. At the same time, increasing precipitation has been observed on average across Russia (+2.2 mm per month per decade), particularly in the Central Far East. A slight decrease of precipitation was observed in central and southern European Russia. The number of extreme events and hydrological hazards increased by almost 3 times between 2000 and 2018.

Future climate change projections show a continuation of the observed past warming trends. Cumulative precipitation continues to increase on average across Russia with stronger enhancements in Siberia and projected decreases in Southern European Russia. However, climate variability and related extreme events are projected to increase particularly in the central and far east region of Russia.



Wildfire is the main natural disturbance factor in Russian forests, responsible for almost 2/3 of damages reported in the official statistics for 2014–2017. Recent trends indicate an increase in average forest fire size (left panel). Noticeable is also an increase in area burnt by extreme wildfire events larger than 10 000 ha (right panel), but disturbance impacts vary a lot year to year.

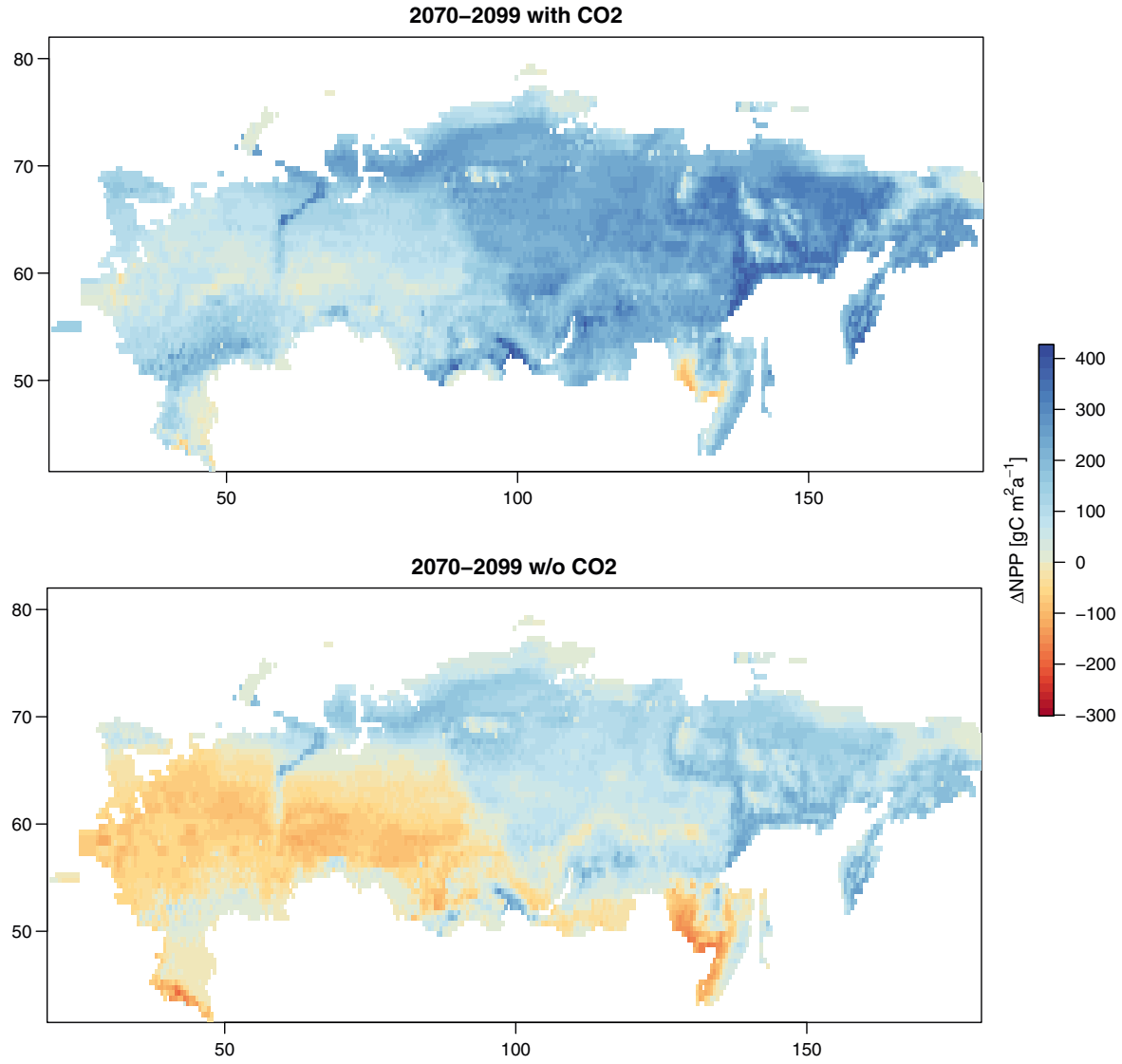


Carbon budget (g C /m^2 /year) of terrestrial ecosystems of Russia for the year 2014 (Shvidenko and Schepaschenko, 2014). Overall, Russian forests provide a substantial carbon sink, but there is large regional variation. Substantial areas act as a carbon source (pink color); these are located either on permafrost or in disturbed forests. It should be noted that the sink estimates presented here deviate from the official Russian reporting to UNFCCC due to methodological differences.

Impacts and adaptation needs

Climate change projections suggest contrasting impacts on Russian forests. These include mostly increasing net primary productivity due to climate warming and longer growing seasons. While forests in the North benefit particularly from climate warming and the consequently longer growing season, the southern ecotone between the forest and arid zones is especially threatened by intensified drought. Future disturbance regimes show increased risks and higher intensity of forest damages with consequent carbon release and disruptions of a steady forest resource flow. Adapting to disturbance risks is therefore of high importance for the Russian forests and forest sector and more efforts in forest restoration after disturbances are needed. On the other hand, disturbances accelerate forest change and hence offer possibilities for adaptation to the changing climate (e.g. adjusting species composition). The regional specificity of climate change impacts requires different adaptation measures adjusted to local conditions.

The decrease of the area of productive forests, and adverse disturbance impacts on quality and quantity of harvested wood as well as the lack of regeneration of commercially valuable tree species are key factors affecting the Russian forest sector. Improved forest governance with new forest policies advocating intensive sustainable forest management and significant investments in the Russian forest sector are needed to reconstruct the forest sector in Russia. The current forest management system requires substantial improvements with a more reliable and operative system of forest inventory and monitoring as well as more effective forest protection under future disturbance regimes. A strategic approach to adaptation also requires a change in the forestry education system. Information on climate change and forest sector adaptation measures should be part of forestry high school education and retraining courses for existing staff of forestry institutions.



Projections of an ensemble of 2 dynamic global vegetation models and 4 global climate models driven by the RCP8.5 emission scenario indicate mostly increasing net primary productivity (NPP) in 2070-2099 relative to the 1961–1990 period due to warming and CO_2 fertilization (top panel). However, high uncertainty remains whether CO_2-induced productivity increases will substantiate. The bottom panel shows the same model projections but keeping CO_2 concentrations constant at 2005 levels. The real response of the vegetation may be somewhere between these extremes.

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