Russian forests are crucial to global climate mitigation

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Russia is the world's largest forest country. Being home to more than a fifth of forests globally, the country's forests and forestry have enormous potential to contribute to making a global impact in terms of climate

mitigation. A new study by IIASA researchers, Russian experts, and other international colleagues have produced new estimates of biomass contained in Russian forests, confirming a substantial increase over the last few decades.

Since the dissolution of the USSR, Russia has been reporting almost no changes in its forests, while data obtained from remote sensing products indicate that Russian forests have in fact experienced an increase in vegetation productivity, tree cover, and above-ground biomass in the last few decades. This has led to inconsistencies in available data and a general decline in the reliability of information on Russian forests since 1988, which can be attributed to an information gap that appeared when Russia moved from the Soviet Forest Inventory and Planning system to its current National Forest Inventory (NFI) for the collection of forest information at the national scale. The first cycle of the Russian NFI was finalized in 2020. The authors of a new IIASA-led study published in *Scientific Reports* have used this data in combination with research forest plots on the ground and remote sensing data, in an advanced analysis to produce a new estimate of the biomass of Russian forests, confirming these forests' climate change impact and their importance for climate change mitigation.

"We set out to determine the live biomass stock and sequestration rate of Russian forests. The joint efforts of our diverse team consisting of representatives from the Russian state forestry agency, forest survey, academic research institutes, and other educational institutions, made it possible for us to produce an important, reproducible scientific result. Even more importantly, our work contributed to building mutual trust, a policy of data sharing, and hopefully, the potential for fruitful future collaboration," says study lead author Dmitry Schepaschenko, a researcher with the IIASA Agriculture, Forestry, and Ecosystem Services Research Group in the Biodiversity and Natural Resources Program.

The team were the first to be given access to a portion of primary NFI plot data with precise location information, which, as in many other countries, is normally restricted for sharing and use, under the condition that the initial data processing was physically undertaken on site at the authorized division (Roslesinforg) of the Federal Forestry. The researchers used this data in combination with remote sensing data to estimate the growing stock of Russian forests and to assess the relative changes in post-Soviet Russia. They calibrated models relating to two global remote sensing biomass data products and additional remote sensing data layers with around 10,000 ground plots from the NFI and the Forest Observation System to reduce uncertainties and produce an unbiased estimation at jurisdictional level. By combining these two sources of information, the team were able to utilize the advantages of both sources in terms of highly accurate ground measurements and the spatially comprehensive coverage of remote sensing products and methods.

"Quite often, practitioners simply use linear regression by default without checking the underlying statistical assumptions or worrying about the difference between the ability of a model to explain the observed data and the ability to predict the future or unobserved data. Because the aim of this study was to estimate the unobserved biomass, we have used modern computationally intensive methods to focus on the goodness-of-prediction of a range of plausible models," explains study coauthor and long-time IIASA collaborator, Elena Moltchanova from the School of Mathematics and Statistics at the University of Canterbury, New Zealand.

The findings indicate that Russian forests have in fact accumulated a large amount of biomass—in the range of 40% more than the value recorded in the country's State Forest Register and reported to the statistics of the Food and Agriculture Organization of the United Nations (FAO). Using the last Soviet Union report as a reference, the results

show that the growing stock accumulation rate in Russian forests between 1988 and 2014 is of the same amplitude as the net forest stock losses in tropical countries. The study's estimate of carbon sequestration in live biomass of managed forests between 1988 and 2014 is 47% higher than reported in the National Greenhouse Gases Inventory.

The authors note that while Russian forests and forestry have great potential in terms of global climate mitigation as well as numerous potential co-benefits relating to the green economy and sustainable development, it is important to highlight that as the climate becomes more severe, as in recent years, resulting forest disturbances might nullify these gains. Close collaboration of science and policy would therefore be critical to elaborate and implement adaptive forest management.

"We are talking here about the largest country in the world hosting the largest share of the largest land biome globally—the circumboreal belt of forest—which is highly climate relevant. Imagine what just a few percent up or down with regard to the amount of forest biomass available and its consequent carbon sequestration potential can make globally," says Agriculture, Forestry, and Ecosystem Services Research Group Leader and study coauthor, Florian Kraxner. "This study once again highlights the important work done by researchers of the International Boreal Forest Research Association (IBFRA), which we would like to acknowledge particularly," he concludes.

More information: Dmitry Schepaschenko et al, Russian forest sequesters substantially more carbon than previously reported, *Scientific Reports* (2021). DOI: 10.1038/s41598-021-92152-9

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