The importance of Russian forests

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Due to the inconsistency of world data on the state of forests, data from the United Nations Agriculture and Food Organization (FAO), which has been publishing summaries of this kind for many decades, are used to show the role of Russia in world forestry.

According to the FAO (2020), the total forest area of the world is about 4 billion hectares. Of this area, 45%, i.e. 1.8 billion hectares are tropical forests, and 27% (about 1.1 billion hectares) are boreal forests (or taiga), which mainly include Russian forests. The remaining 28% are temperate and subtropical forests. Among the countries of the world, Russia ranks first in terms of forest area – with 815 million hectares (21% of the global forested area).

Unlike the rapid destruction of tropical forests of Africa, Latin America and Southeast Asia, boreal forests (2/3 of which are located on the territory of Russia) are stable in area. If we take into account the new forests that have arisen on abandoned agricultural land, but are so far ignored by the authorities, then the area of Russian forests is increasing. At the same time, there are negative changes in their species composition. Due to fires, clearing, the impact of diseases and pests, the areas of typical coniferous stands (spruce, pine) are somewhat reduced, and these species are being replaced by secondary species – birch and aspen.

The total area of intact forests in the world that have still not experienced significant anthropogenic impact is about 1.1 billion hectares (i.e. more than a quarter of all the forests in the world). According to the FAO, the largest areas of intact forests have been preserved in Russia: 255 million hectares.

When using Russian forest statistics one should be aware that a number of the indicators they contain may differ from corresponding FAO estimates. FAO figures allow for maximum comparability of data at the global level. Russian forest statistics allow for a deeper and more detailed analysis.

According to Rosreestr, the Russian statistics agency, as of 1 January 2020 the forest lands of the Russian Federation covered 897 million hectares. The definition of forest land includes land occupied by forest ecosystems, as well as land intended for growing forests, but temporarily devoid of forest cover (burnt areas, dead stands, clear cuts, etc.). The main area of forest land is part of the Forest Fund (863.4 million hectares, or 96.3% of their total area), for which there is the most detailed information on the species and age composition of forests. However, official statistics ignore the presence of 34 million hectares of forests that have grown in recent decades on currently unused agricultural lands.

The average forest cover on Russian territory in recent decades has remained quite stable. At present it is 46.5%, but it varies greatly from region to region: from 0.2% in the Republic of Kalmykia to 82.5% in the Irkutsk region. About two-thirds of all forests in the Russian Federation grow on permafrost, which occupies vast areas of Siberia and the Far East.

On land managed by the Forest Fund and occupied by the main tree species, coniferous forests (mainly larch, pine and spruce) prevail, occupying 76% of the area. Deciduous forests (mainly birch and aspen) occupy 22% of the area, while the rest of the territory (2%) is populated by hardwoods and shrubs.

Looking at statistics on changes in the forest area of Russia, it is worth noting that, at the beginning of 2021 (compared to 2000), the forest area of the Russian Federation slightly decreased, namely by 1785 square kilometres. The decline in forest area was mainly driven by two factors:

1. **Illegal deforestation in the Russian Federation;**
2. **Large forest fires that have occurred over the past five years in particular.**

As noted in the Strategy for the Development of the Forest Complex of the Russian Federation until 2030, approved by decree 312-r of the government of the Russian Federation on 11 February 2021, the problems of conservation and use of forests are becoming more diverse and complex. Forest management standards are changing to meet increased international, social, environmental and economic requirements. Threats of harmful organisms, forest death from fires, and other adverse factors have increased due to the consequences of climate change, as well as the risks of loss of forest biodiversity.

Andrey Laletin

Flora and fauna of the Siberian forests

The most important factor influencing plants and wildlife distribution is climate. At the northern limit of tree distribution in the forest tundra of Siberia the mean annual soil temperature is -1 to -3C. Around a hundred days a year have air temperatures above +5C, and only 57–70 days are above +10C. At the northern limit of distribution, trees grow in scattered groves on gentle southern slopes. Such forests grow on poor shallow soils that are low in humus, producing low-density forests. In the western Siberia such forests are composed of four tree species: Scotch pine (Pinus silvestris L.), Siberian spruce (Picea sibirica Ledeb.), Siberian [cedar] pine (Pinus sibirica Du Tour), and Siberian larch (Larix sibirica Led.). In eastern Siberia and the Russian Far East there is Daurian larch (Larix dahurica Led.). Among deciduous trees a few species of birch (Betula spp.) and aspen (Populus tremula L.) are common. Few rare plant species are found in the north of western Siberia (only one is listed in the Red Data Book – arctic paintbrush (Castilleja arctica Krey et. Serg.)). Up to 80 percent of all forests are old-growth. As we move southward, the stands become denser and taller. The productivity also goes up. The forest composition remains essentially the same. The southern part of the northern taiga subzone is dominated by Scotch pine in Western Siberia, Siberian larch in Central Siberia, and mostly Daurian larch in Eastern Siberia.

The middle taiga typically has forests of spruce, Siberian pine and fir interspersed with secondary groves of birch and aspen. Pine forests are found in wetlands. The southern taiga has very diverse forests. They are more productive (up to 500 m^3 per ha), and their composition is more diverse. Another aspect of the southern taiga is a lower proportion of wetlands. Soils in the area are fertile, well suited for agricultural production on cleared sites. Forest steppe is a separate natural zone. Some of it was artificially created

by humans. Forest groves in this zone alternate with hay meadows and pastures, as well as with crops. In some cases, the productivity of such forest islands remains quite high (500 m^3 per ha and more), usually these are Scotch pine forests. In other cases, due to increased aridity, productivity somewhat declines. Plant diversity here equals that of the southern taiga.

Most rare species are found among the best studied groups of animals, such as mammals and birds. Birds have the most species among the vertebrates. Avifauna increases from 145–160 species in forest tundra to 215–224 species in southern taiga. While the overall bird diversity increases towards south, the variation in the number of nesting pairs does not demonstrate any regular trend. There is a pronounced decline in both species diversity and population numbers in the habitats with the lowest productivity – in bogs. The following species were found by different authors in Western Siberia among transient or uniquely occurring rare birds associated with forests or forested landscapes: snake eagle (Circaetus gallicus Gm.), gyrfalcon (Falco rusticolus L.), mountain double snipe (Gallinago solitaria Hods.), swan eagle (Aquila heliaca Sav.), hooded crane (Grus monacha Temm.), white-naped crane (G. vipio Pall.), Siberian white crane (G. leucogeranus Pall.), and common spoonbill (Platalea leucorodia L.).

Information about the numbers and diversity of mammals is generally of less interest. First, there are almost no papers available summarising population data for all the existing mammal groups, since each group is typically counted separately by different methods. Second, numbers of small mammals vary widely from year to year. The available data is generally comparative and only describes increases or decreases in numbers from year to year – not the actual density per unit area. This lack of quantitative data applies to larger mammals as well. Only one subspecies of mammals qualifies for rare status in the north – the Putorana subspecies of snow sheep (Ovis nivicola borealis Sev.). A 330,000 ha nature preserve ("zapovednik" in Russian) has been created for its protection. About 1,500 sheep inhabit this area. Among mammals listed in the Red Data Book in the south of the Western Siberia, I should mention the eared hedgehog (Erinaceus dauricus Sun.) from Achinsk forest steppe, and the decline in the population of long-tailed nocturnal bat (Myotis longicaudatus Ogn.). Finally, many game species of mammals are declining, especially river otter and roe deer.

Concerning impact on the flora and fauna, most of the existing data concern birds and mammals. Inhabitants of steppes and forest steppes, and shore birds have experienced the greatest decline. Spoonbill, for instance, has disappeared from the south of Central Siberia, as well as from Western Siberia. The decline in the number of hooded crane was only recently halted. Other crane species remain rare migrants. On a positive note, the populations of two very rare Western Siberia raptors – the imperial eagle and Saker falcon – have stabilised in the south of Central Siberia, where they are relatively common. An important indirect factor of human disturbance might be an increase in competition and predation due to human activities. In dry years in the steppe and forest-steppe zones the mowing and grazing of hay meadow increases greatly. This destroys grass habitat for many wild animals.

Trees are the best studied of all the Siberian organisms. There is no reason to expect that any new tree species will be discovered in the Siberian taiga. Similarly, it is improbable that any tree species could become threatened without this being immediately noticed. Extensive reports about the current state of the forests of Siberia are scattered in many

journals and monographs. Analysis of this literature from the standpoint of forest state and protection shows that depletion of mature stands in the most accessible areas continues to occur. On the other hand, the most remote areas experience little use, as before. Natural regeneration of cut areas, especially in the southern taiga is not going well. In the most disturbed southern forests a very common process is the replacement of coniferous forests after clear-cutting with deciduous second-growth. If enough coniferous stock is present around the site, coniferous forest will eventually regenerate as a result of succession. However, since coniferous trees are being logged first and in ever-increasing volumes, natural seed sources in the vicinity of the clearcut disappear, and the restoration of coniferous forests is initially delayed and finally stops. Replanting coniferous forests artificially and providing adequate maintenance is impossible today, considering the overall economic situation in Russia. This situation further accelerates the felling of conifers near major industrial centres, since the development of new areas is a costly affair. Fire protection has become problematic, and many fires are nowadays caused by careless members of the public who do not observe fire safety rules in forests. Overall, a lot is known about the precarious situation of the Siberian forests. However, simply listing the difficulties does not help to resolve the issues.

An evaluation of species diversity and trends was published in a monograph by Malyshev (1994), and also by Vodopyanova (1984), providing lists of species discovered on plots measuring 100 square kilometres each from tundra to southern taiga. Information about rare species appears in the Red Data Book of Russia (RDBR 2020). There are few rare species in Siberia, mostly endemic species concentrated around Lake Baikal. Another source of information is lists of flora from various zapovedniki. This information shows which Red Data Book species occur in nature preserves, and are therefore protected.

Altaiskii Zapovednik has eight species of plants from the RDBR. This is 27 percent of the total number of endangered or threatened plants of Altaiskii Krai. Only 23 percent of all RDBR species occur in "Stolby" Zapovednik near Krasnoyarsk, and only 20 percent in Sayano-Shushenskii nature preserve. Baikalskii Zapovednik hosts 18 percent of all rare plants in the Baikal region. The most widespread of the rare species are also those most commonly found in the preserves (such as orchids – lady's slipper (Cypripedium calceolus L.), large-flowered lady's slipper (C. macranthum Sw.), Epipactis aphyllum Sw., Dactylorrzhia baltica Kling., Orchis militaris L.). The number of rare species rapidly declines as we travel northward. Most rare species concentrate there in the Chukotka peninsula tundras. No zapovedniki have yet been established there. At the same time, the zapovedniki were primarily set up in the north, where land is the least valuable.

Another aspect of zapovedniki is their role in conserving plant species diversity. When we understand the composition of the regional flora and fauna of zapovedniki in one region, we can compare the two to figure out how well the zapovednik represents the flora of that region. It turned out that the most representative was the flora of Altaiskii zapovednik (80% of the regional species were found there, but only 27% of the Red Data Book species!). Sayano-Shushenskii Zapovednik includes 48.4 percent of all flora of the Siberian south. Together with Stolby Zapovednik they include 56 percent. Similar figures were obtained for preserves outside the territory discussed in this paper. Thus, Kronotskii Zapovednik in Kamchatka has 73 percent of plants in the peninsula and 58 percent of those in the Kamchatka oblast. Overall, data of this sort are in short supply.

It must be mentioned that the theoretical relationship between the number of plant species and the area is well-established in ecology (Arrhenius equation).

Siberia, like the rest of Russia, is at a crossroads today. It is hard to predict what the state of natural resources will be in the region in the future. It is, however, possible to take specific measures to protect existing natural sites that are the most threatened today. The surviving forests in the vicinity of major industrial and urban centres in Siberia are clearly becoming sites that require such protection. They mostly include the taiga between the middle taiga boundary and the foothills of southern Siberian mountains. The Far Eastern timber industry is a target investment area for international investors. On the other hand, as logging in the middle taiga dwindles, it is shifting to the southern taiga, and to the foothills, already heavily degraded by timber cutting. The last remaining coniferous stands that survived massive logging by powerful lespromkhozy (state timber companies) are now being felled at an unprecedented rate. As a result, the last remaining seed sources of conifers in the southern taiga are becoming rapidly depleted, and birch and aspen gain a competitive advantage. Forest replanting is minuscule due to lack of funding. Even if some replanting is done, quite frequently saplings die because no maintenance is provided. In such conditions, it is essential to create reserves to protect the last coniferous stands in forest steppe and southern taiga. Such reserves will provide a crucial seed base for restoration projects in their vicinity after the current economic crisis, hopefully, ends. Otherwise, it will be necessary to import seeds from other locations. This will alter the genetic composition of local tree populations, and may preclude the recreation of healthy stock.

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