Development and Utilization of Russian Forest Resources

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A presentation based on the historical development of Russia is given in the form of an overview of the development of Russian forest resources, of the wood, non-wood, and biological aspects of the forest ecosystem. The list of non-wood forest resources includes resin, saps, oils, berries, wild nuts, mushrooms, hay harvesting, game animals, etc. The dynamics of the system are presented in the light of the data of the Forest State Account (FSA) of Russia for the period 1956–1993. The most significant changes in the dynamics of Russia's forest resources are related to concentrated, large-scale wood harvesting operations. The dynamics of non-wood resources follow the process of the economic recession in all parts of the forest sector of Russia, the said recession having begun in the mid-1980s. The forests of Russia are considered to be of immense social and cultural value and a globally significant factor contributing to the sustainable development of forest resources.

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1 Introduction

Dynamic changes taking place in Russian forests determine the levels of biological diversity and sustainability of the biosphere in Russia. In many respects such situation is considered to be of vital importance owing to its scale: forest lands make up ca. 69 % of Russia's territory (including inland waterways), 78.5 % of the closed-canopy forests being situated in the Russian Federation's Asian region and 21.5 % in the European and Urals regions (EUPR). The closed-canopy forest lands account, on an average, for 45 % of the forest cover (38 % within the EUPR).

The Forest State Account (FSA) is based on periodic generalization of data obtained through management inventories and in the course of planning work. In the case of forests not under management the corresponding data are obtained in the form of material from aerial evaluation of forests and by interpreting satellite imagery. The

records in the FSA are linked to the administrative units in charge of the forest lands at different levels. On average, the FSA data are updated every five years throughout all the forest management levels. The data of FSAs are available relating to January 1 for the years 1956, 1961, 1966, 1973, 1978, 1983, 1988, and 1993 (Reference book ... 1995).

The accounts' categories used in FSA were established in Russia two hundred years ago for describing the mosaic of plant life, waters, roads, land use, settlement, and so on as the result of economic and natural processes. The study and analysis of dynamics of the forest resources in Russia should be of assistance in the practical implementation of the strategy of sustainable forest management, a strategy that could lead to reduced accumulation of atmospheric emissions of carbon dioxide. The following analytical information concerning the forest resources of Russia may be useful in the endeavour to achieve balanced development of the different regions of Russia. This approach is based on investigations carried out at the ARICFR.

2 A Brief Ecological History of the Russian Forests

Annalists bear witness to vast forests and woods around the settlements of the ancient inhabitants of Russia along the Dnieper river and in the city of Kiev, the ancient capital of Russia (currently the capital of the independent Republic of Ukraine). However, there are no records of these forests following the 11th century: by that time they had disappeared. Reports do exist on the past existence of dense forest cover in the extreme north-east of the European Urals region of Russia (EUPR). By exploiting arable land already established instead felling forests along the rivers, ancient Russians felled trees close to their homes to satisfy their need for wood raw material and when necessary they also cleared land for agricultural purposes. Such a way of making one's home and selecting places for felling trees was retained throughout the following centuries. From 14th to 16th century, there was a special routine for carrying out felling in the forests of the central regions of the EUPR which were of great strategic value (e.g. the Tula abatis) and played a significant role in defending the country against the forays of ancient Turkish tribes, who called these forests "great fortresses".

Since the 17th century factories consuming timber and charcoal have been set up. From the 18th to the end of 19th century, high-quality shipbuilding timber was consumed by the navy and the merchant fleet, while large-sized timber (in second place as regards wood consumption) was mainly demanded by artillery forces. Since the 19th century the railway network developed within the EUPR, and this meant demand for sleepers, firewood, telegraph poles, as well as for structural and carpentry timber.

For a long time, the buildings of settlements, including cities, in Russia was mainly based on wood. Numerous forest products (masts, shipbuilding timber, resin, etc.) were exported to European countries on a large scale. As compared to other regions, the forests of the central regions of the EUPR were cleared to make arable land much earlier. In the 17th century it was observed that there was a relatively auspicious age structure in these forests. However, young-growth stands and clearings turned out to be nearer to waterways and cities, whereas mature forests grew in the more remote areas. The steady population increase between the 18th and 19th centuries made it necessary to clear more arable land, but no reserves of land were available in the EUPR. The intensive wood harvesting which took place in private forests in 19th century was a natural course of events in the endeavour to meet the economic development, at first, with the birth and then with the further development of a capitalist economic system in Russia (Arnold 1884).

The increase in population was accompanied by an increase in area of arable land, hayfields, and pastures, and a decrease in the area of forest (Bobrov 1990). According to annalists and the data compiled by the Ministry of State Property of Russia (the body that produced periodically the economic and statistical atlas of European Russia), the forests covered 44 % to 95 % of the total land area. For a period of 219 years (1696–

1914), there was a steady decrease in the percentage of forest land in European Russia: 52.68 % in 1696, 51.16 % in 1725, 42.27 % in 1861, and, finally, 35.16 % in 1914. However, that percentage decreased unevenly in different regions. The well-forested regions were affected least of all. So, for instance, by 1915 about 91.8 % of the initial forest area was still retained in the northern parts of European Russia (Arkhangelsk, Vologda and Olonetsk Regions), 80.6 % in the Perm Region, and 77.4 % in Novgorod, Pskov and St Petersburg Regions. The most drastic reductions in forest land were observed in the regions of central and forest-steppe zones.

The average rate of forest clearing in the European Russia amounted to 203 000 to 233 000 ha per annum in the 17th century; in the first half of the 19th century the figure was 164 000 ha. Between 1862 and 1888 (i.e. after the abolition of serfdom and up to the adoption of the "Regulations on Forest Conservation") ca. 900 000 ha of forests were cleared every year (Belin 1962). At the end of the 19th century and at the beginning of the 20th century, the rate of forest clearing was somewhat reduced to what it had been earlier. Within a period of 200 years, about 67 million ha of forests had been cleared in European Russia and converted into arable land, household gardens, and to provide land for housing. At the same time, reforestation was carried out on only 1.26 million ha (2 % of original forest area), including 0.7 million ha of forest planting within the bounds of forest districts (as a result of reforestation of harvested sites in forestry), and only 0.6 million ha consisted of afforestation of new sites (Arnold 1884, Bobrov 1990). Hence, strictly speaking, restoration amounted to only 1 %. During the period 1695–1914, the forest area within the EUPR was reduced by one third, i.e. the percentage of forest land decreased from 52.7 % to 35.2 %, mainly as a result of clearing forests for the purpose of expanding arable land. Unrestricted felling of forests took place during the period of the Civil War (1917–1920).

The documented history of developing the Asian part of Russia goes back to the era of Czar Peter the Great and his contemporaries, i.e. to the end of the 17th century, despite the fact that the first settlers from European Russia reached Siberia and the Far East as early as in the 16th century (Bobrov 1990, Pisarenko et al. 1995) . In view of the extremely long distances, the impact of the development of the thinly populated Asian Russia on the region's forest resources gained in importance since the second half of the 19th century. The intensive process of settling and developing the forests of Siberia and the Far East began at that time, and it has been accompanied by the study and detailed description of the forests of the region, including the botanical characteristics of the timber species, the discovering of the northern boundaries of the forests, and the various ways of forest exploitation practised by local people.

By 1925–1928 Russia had regained the level attained in 1893 concerning industrial wood harvesting, manufacturing of sawn goods and plywood (manufacturing of pulp and paper proved to exceed the level achieved in 1893). However, the demand for timber (in particular, as a source of hard currency) increased more and more (History of ... 1960, Koldanov 1992). With this end in view, work was commenced on establishing mechanised wood industry. Between 1926 and 1937, extensive industrialisation of the country took place. Principles of forest management such as sustainability of forest use hindered the turning out of unlimited quantities of wood of varying quality.

By 1975 the scale of forest use and forest conversion reached the mark of 366 million cubic metres of harvested timber. This was a period of economic development when the nation's forest resources were severely damaged, especially those in the north (taiga). The volume of forest use was controlled by "planned needs for timber" (Koldanov 1992). Actual wood harvesting sites were chosen mainly with the aim of procuring timber of high quality closest to major transportation routes, and without concern over issues of ensuring even-paced and sustainable forest use. The felling outturn pattern had nothing to do with the tasks of reasonable forest management, and all forest issues were, as a rule, subordinated to the interests of wood procurement.

3 Dynamics of Russia's Wood Resources

According to the FSA data, there was between 1966 and 1992 a rise in the average annual loss of stocked forest area as regards the main timber species, including conifers. This process took place over the whole of the Soviet Union, both in the EUPR and in the Asian parts (Fig. 1). As regards hardleaved broadleaves, a similar rise took place only within the EUPR. At the same time, there was a tendency towards an increase in the average annual growth of softleaved broadleaves stands (Fig. 2), especially within well-forested regions (such as the Northern and the Urals regions).

The age structure of Russian forests is characterised by a predominance of mature and overmature stands (47 %), including ca. 50 % for conifers, despite the decrease in the area covered by such stands during the period 1988–1993. This was due to felling and reduction in the area of coniferous stands by almost 39 million ha. Simultaneously, there was an increase in the proportion of young increment stand and middle-aged stands. Between 1966 and 1992, the proportion of forest covered by mature and overmature stands was reduced by an average of 0.58 % per annum (including reduction by 3.7 % between 1988 and 1992, corresponding to a decrease of 0.74 % per annum). As regards the EUPR, the corresponding figures were 13.0 % and 0.48 %, and during the period 1988–1992 the figures were 0.6 % and 0.12 %, respectively.

As regards conifers, the proportion of forest area covered by mature and overmature stands was somewhat reduced during the aforementioned period: on the national scale by 17.9 % (on average by 0.66 % per annum) and by 4.8 % between 1988 and 1992 (on average by 0.96 % per annum). As regards the EUPR, the said indices amounted to 17.1 % (on average to 0.63 % per annum) and for the period 1988–1992 by 0.6 % and 0.12 %, respectively). By the year 2000, the age structure of all species groups is expected to be characterised (on the national level) by the predominance of the proportion of stocked forest area covered by mature and overmature stands (45.3 %), including 47.6 % of coniferous

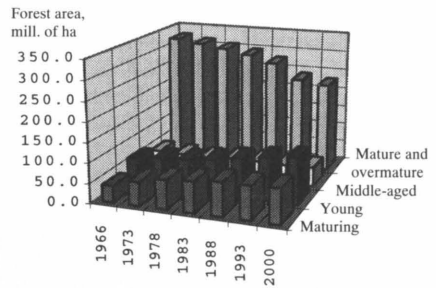

Fig. 1. Russian coniferous forests.

stands. However, the area covered by mature and overmature stands is expected to decrease, on the national level, by 1.7 % between 1993 and 2000, including by 2.3 % for coniferous stands. As regards the EUPR, the said indices are expected to amount to 1.4 % and 2.4 % (for conifers), while in the Asian part of Russia the corresponding values are expected to be 1.8 % and 2.2 % (for conifers). There will take place a subsequent redistribution of the forest area among age groups resulting in a smoothing of the age structure (Strakhov et al. 1995).

In Siberia and the Far East, as well as in the well-forested regions of the EUPR, natural regeneration is of great importance owing to young growth, understorey trees, and second growth being retained when felling timber, and also due to assistance given to subsequent regeneration. For instance, provided the regulations of felling and harvesting technologies are observed, the natural peculiarities of the forests in the Krasnoyarsk Territory provide grounds for expecting successful natural regeneration with commercially valuable species on up to 90 % of the harvested areas within the Angara-Yenisey taiga forest industries region, and on up to 60 % within the southern mountainous taiga forest industries region.

Over the last two FSA periods, a considerable decrease has taken place in the total volume of standing forest in Russia: between 1982 and 1987 there was a fall of 0.78 billion cubic metres, and between 1988 and 1992 the loss was 1.67 billion cubic metres, including 1.15 and 2.48 billion cubic metres of coniferous wood. As regards

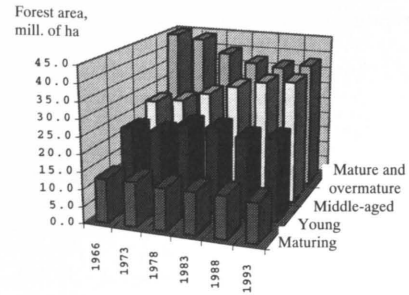

Fig. 2. Russian broadleaved forests.

softleaved broadleaves, the corresponding standing volume increased: by 0.35 billion cubic metres between 1982 and 1987, and by 0.78 billion cubic metres between 1988 and 1992. The decrease in standing volume occurred at the expense of the Asian part of Russia (Tiumen Region, Krasnoyarsk and Khabarovsk Territories, Sakhalin Region, and the Republic of Sakha-Yakutia). As regards the EUPR, it has been observed since 1966 that there is a shift towards an increase in the total standing volume (and in the standing volume of coniferous forests) owing to the increase in the total average increment and the steady smoothing of the age structure in the region. During the past forest account period, the total standing volume in the EUPR increased by 0.53 billion cubic metres, including 0.09 billion cubic metres of coniferous forests (Strakhov et al. 1995).

The gross average increment of the standwise standing stock of the main timber species increased between 1988 and 1992 by 14 billion cubic metres, including 6 billion cubic metres within the EUPR. The average timber volume per hectare of all tree species amounted to 112 cubic metres on the national level according to FSA 5, including 114 cubic metres (permanently) for coniferous species. The average annual increment per hectare of stocked forest land (main timber species) on the national level amounted to 1.29 cubic metres (data for 1.1.1993), including 1.07 cubic metres for coniferous species (1.09 cubic metres in 1988). As regards the EUPR, the aforementioned index amounted to 2.04 cubic metres for the main timber species (2.01 cubic metres in 1988), including 1.60 cubic metres for coniferous species. This index turned out to be considerably lower when compared to the values for average increment in the forests of some other boreal countries. In addition to the concept of increment having a different meaning in Russian statistics, this can be accounted for by unfavourable climatic conditions, the presence of vast permafrost lands and peatland areas in the Russian North, Siberia, and in the Far East (i.e. in the regions containing the major timber resources). This is further supported by existence of large areas covered with stands of site class IV.1 (i.e. below-average site class), the average site class being 4.3 for coniferous species. On the national level, the stocked forest lands characterised by site class V or less for the main timber species amount to 46.3 % of the total stocked area, with only 10.3 % falling into the categories of site classes I or II. Within the EUPR, the average site class is 3.5 for all species, and 3.9 for coniferous species. There the proportion of forests growing on poorer site classes (V–Vb) is especially high, especially in the North Economic Area (59.8 % of the total stocked area and 67.2 % of the area covered by conifers).

According to our estimates, it is most likely that the stocked forest area comprising the main timber species will increase, on the national level, by 5.1 million ha during the period 1993–2000 (mainly because of young increment stands), including 3.7 million ha of coniferous forests and 1.8 million ha of softleaved broadleaves forests. A similar shift is believed to take place within the EUPRR and in the Asian parts of Russia. The proportion of conifers within the stocked forest area comprised of the main timber species over the country as a whole is expected to stabilise; within the EUPR, there is expected to occur a decrease of 0.2 %, whereas softleaved broadleaves are expected to increase their share by 0.1 %).

4 Dynamics of Russia's Non-Wood Resources

According to Russian forest legislation, the following forest uses, in addition to wood harvesting, are permitted: a) gum tapping; b) harvesting of secondary by-products (stumps, bast, rind, birch bark, twigs of fir, spruce and pine); c) concurrent forest exploitation (haymaking, grazing, beekeeping, sap extraction, collecting of wild fruits, mushrooms, berries, nuts, medicinal plants, industrial raw materials, moss, litter, etc.). Natural non-wood, plant-based foodstuffs, together with forest game, are integral parts of forest ecosystem production. They have an essential additional function in satisfying the multiple needs of local people as regards food. Wild fruits, berries, nuts, and mushrooms are foremost among these. Nearly 200 species of fruit trees, shrubs, dwarf shrubs, and climbing plants bearing edible fruits grow in Russian boreal forests. The directive "Instructions for carrying out forest inventory and planning " now in force (Instruction for ... 1995) requires that an account be made of the food resource, medicinal plants, and technical raw material when evaluating forest resources.

Tapping and Resin-Tapping

Mature and overmature stands of pine, spruce, Siberian stone pine and larch are considered to be assigned for final (2nd and 3rd group forests) or regeneration felling (1st group forests) as resources for tapping,. The gum obtained when tapping coniferous trees (mainly pine) is used to make important products such as resin and turpentine. Resin is used in the manufacturing of paper, lacquers, dyestuffs, soap, as well as by chemical, petrochemical, metallurgical, food industries, etc. Before 1917, tapping was conducted on an experimental basis in Russia. It is since the 1920s that it has attained an industrial scale. On the national level, the gum yield per hectare (kg) averaged as follows:

Year:	1973	1974	1975	1976	1977
Gum, kg/ha/year:	71.4	65.9	71.6	72.0	73.6

According to the data provided by the latest forest account (1.1.1993), the total area of pine stands that can annually be exploited for tapping purposes amounts to 1 712 200 ha (with 766 500 ha within the EUPRR and 945 700 ha in the Asian parts of Russia) (Reference book ... 1995). The total area of pine stands exploitable for resin tapping amounts to 413 100 ha (with 243 900 ha within the EUPRR and 169 200 ha in the Asian parts of Russia) (Strakhov et al. 1995).

Production of Tree Saps

Mature stands of birch are the foremost source of tree saps. The diameter of tapped trees must be in excess of 20 cm. Sap yields in suitable stands of birch can be as high as 20–30 t/ha during one season. Tapping is carried out 5–10 years prior to felling. Less than one third of birch stands suitable for sap are actually tapped. The leading source of birch sap in Russia was the Central Economic Region providing more that 40 % of all sap produced, followed by the West Siberian Region (18 %) and the Volzhski Region (16 %). The actual average annual production volume during the period 1970–1978 was 4300 tons, in 1976–1983 it increased to 11 000 tons (in the European-Urals part to 8600 tons). These were more than enough to meet the demand (Strakhov et al. 1995). Now, due to lack of markets, the production of birch sap has almost disappeared, and sap has become a rarity.

Medicinal Material

Over 2000 species of vascular plants with medicinal properties grow in the forests of Russia. Over 600 of them can be used by the pharmaceutical industry. Of the 200 species of used by the medicinal industry in 1987, 150 were purely forest species. Up to 70 % of the medicinal material purchased each year is based on wild forest plants. The resources of medicinal plants are far from having been fully explored, and more or less comprehensive data are available only for some species in some of the regions (Strakhov et al. 1995). As the enumeration and description of all the medicinal species of forest plants are not the goals of this paper, the main attention is paid to the most common of such species.

Purchasing and processing medicinal raw material are highly profitable for forest management units. In 1986 there were nearly 80 specialised forest reserves in Russia. In many regions, as a result of an unsystematic and non-regulated exploitation, dramatic changes occurred in the proportions of biological and commercial stocks of sea buckthorn, dog rose, *Schisandra chinensis,* ginseng, snowdon rose, sand immortelle, etc.

The past years' average annual purchases of forest commodities by Russian forestry enterprises were as follows: "chaga" 25–27 tons, birch buds 10–12 tons, oak bark 7–9 tons, hawthorn 7.5 tons, buckthorn 4.5 tons, dog rose 2000–2500 tons, *Leuzea carthamoides* ca. 2 tons, Eleutherococcus over 23 tons, *Oplopanax* 3 tons, Saint-John's-wort over 2 tons (dried), Immortelle over 2.5 tons, bearberry ca. 3 tons, sea buckthorn 400–450 tons. The statistics of the Federal Forest Service of Russia report volumes of purchases of medicinal and technical raw material in combination. In all the regions the purchase volumes varied depending on the actual crops.

Honey Collecting

The collecting of honey differs from the collecting of other forest-based foodstuffs. The forest vegetation (several species of trees, shrubs, and herbs) constitutes a real source of honey in Russian. To collect it, one has to establish apiaries in forests and entrust their care to skilled personnel, beekeepers who keep an eye on the state of the beehives and attend to the timely extraction of honey. According to the Forest Account for 1.1.1993, the area of forest stands dominated by lime (when in flower, lime is a very important nectar source) exceeded 3 million ha, and 73 % of such forests (2.2 million ha) were in the European-Urals part of Russia, mainly in the Urals (48.7 %) and Volga-Vyatka (6.7 %) economic regions (Reference book ... 1995). During one season a hectare of a lime forest can yield up to 50 kg of honey. Another 'honey tree' is the locust (60 % of the honey-bearing capacity of lime) and willow (30 %). Many forestry enterprises are familiar with beekeeping; the apiaries maintained by forest management units (*leskhozes*) are only a little smaller than those of collective farms (Strakhov et al. 1995). The honey from Bashkortostan, North Caucasus, and Primorye enjoys the highest demand both on the domestic and foreign markets. The honey yield (as well as harvest of other non-wood forest products) directly depends upon weather conditions, especially when nectar-bearing plants are in blossom.

As honey is supplied not only from forest lands, but also from the fields of collective farms and from other "green belts", we consider it appropriate to take into account only products supplied by forestry enterprises. During the period 1970–1977, the average annual volume of the honey supply was 762.6 tons for Russia as a whole (Strakhov et al. 1995).

Research into the resources of such plants in all regions is an important challenge from the viewpoint of the wise use of forest foodstuffs. The area under wild fruit trees and shrubs (excluding nut trees and chestnut), as accounted on 1.1.1993, amounted to 42 100 ha for Russia as a whole, including 35 700 ha within the EUPR (Reference book ... 1995). In actual fact, the area is much larger: forest accounts often fail to mention areas of berry and fruit plants growing under the forest canopy and cases where they form less than 10 % of the forest stand.

A summary survey of the wild fruit and berry resources of Russian forests was compiled by ARICFR experts on the basis of information provided by the most recent State Forest Account (Reference book ... 1995, Strakhov et al. 1995), reports by inventory and planning enterprises, public literature sources (references), and data obtained by regional forest experimental stations. The computed biological stock was "shared among users". Birds and mammals usually consume 20–70 % of the biological crop (depending on the year's yield and animal population density in the given region). The computations applied 50 % of the biological crop as the average index of consumption by animals in all the economic regions, except for the eastern regions where the corresponding figure was 70 %. The remaining part of the biological stock was deemed to be the commodity resource. Then,

and bearing in mind the coefficient of accessibility (estimated by the experts for each region), computations were made as to the share of the commercial resources in the commodity resources. The commercial resources provide the commercial supply and domestic consumption by local people. The losses during harvest (trampling) amount to nearly 40 %. Thus, only 60–40 % of commodity resources, or 10–30 % of the biological crop can actually be used by local people for household consuming.

Wild fruits and berry resources are the most important. The annual biological crops of the major berry species are as follows: cowberry 3 260 000 tons, bilberry 1 800 000 tons, blueberry 640 000 tons, cranberry 1 100 000 tons. According to calculations, their mean biological yields exceeds 5 million tons throughout the country, and the accessible commercial resources approach 600 000 tons. Currently, less than 30 % of the commercial resources are exploited, but in several regions the figure is over 60 %, and 90 % in the Central regions.

Wild Nuts

Forest tree and shrub species producing nuts are valuable resource components and they add to forest biodiversity.

Pine Nuts

Pine nuts produced by *Pinus sibirica, P. koraiensis, P. pumila.* The forests of *P. sibirica* and *P. koraiensis* are spread over 39.8 million ha, and those of fruiting age cover 27.2 million ha. Besides these, special commercial nut zones have been set aside on forest lands covering 10.9 million ha with these pine stands occupying 6.8 million ha. The total area of *P. pumila* in the mountain regions of East Siberia and the Far East (including Kamchatka, Sakhalin and the Kuril Islands) is 37.6 million ha, with those of fruiting age covering 35.9 million ha. High nut crop seasons occur every four or five years in the case of *P. sibirica* and every three or four years in the case of *P. pumila*. The average yield per hectare depends on stand age, stand density, and the proportion of pine in the stand. Pine nuts are a foodstuff of high value. They contain – on average – 60 % vegetable fats, up to 16 % of proteins, and up to 12 % of carbohydrates. In terms of its oil content, they excel almost all oil plants, including sunflower. The oil produced from pine nuts excels – in terms of its taste qualities – many vegetable oils, and it could be a fairly good export product of high value. The value of pine nuts gathered during one felling period exceeds the value of timber that could be taken from the same hectare of forest land.

Hazel

Hazel occurs on large areas in the forests of Russia, mainly as undergrowth. Only according to forest account as for January 1, 1993, the area of fruiting hazel stands is 10 200 ha, calculated area of hazel under forest canopy adds nearly 1.8 million ha (Reference book ... 1995). The core of hazel nut contains up to 22 % of proteins, 77 % of fats, 13 % of sugar and many vitamins. It is also rich in cobalt that stimulate producing blood corpuscles and hemoglobin. Now hazel resources are being depleted, its thickets are not managed. Therefore it yields little (20–30 kg) ha in stands under forest canopy).

European Walnut

European walnut *(Juglans regia):* occurs as natural stands mainly in the North Caucasus region. The European walnut is a valuable foodstuff, contains up to 65 % of fats, up to 17 % of proteins, up to 16 % of carbohydrates, and many vitamins. The oil produced from it is equal to olive oil. Walnut oil cake is a very nutritive feed. According to the last forest account, the area of European walnut stands amounts to 9600 ha, and those of fruiting age cover 4900 ha. Average yields vary from 120 to 300 kg/ha. When applying an average yield of 200 kg/ha, its average biological resources (bearing in mind that the stands are mixed) are estimated to be amount to 720 tons per annum, and the commercial resources are estimated to be 320 tons.

Manchurian Walnut

Manchurian walnut *(Juglans mandschurica):* occurs only in the Territories of Primorye and Khabarovsk. It covers 6600 ha (of fruiting age, beginning at age of 6–7 years). It grows mainly as an admixture with other species that make up 50–60 % of the stand composition. Therefore, the productive area is actually half of the above, i.e. 3300 ha. Taking into account its yield per hectare and its age, the crops of Manchurian walnut are estimated to average at 500 kg/ha. It fruits every year, but abundant crops occur every second or third year. Thus, its biological crop averages 1650 tons per year, and the commercially accessible resource is estimated to be 800 tons per year. The Manchurian walnut's nuts are mainly gathered by local people for household consumption, and commercial purchases are minor.

European Chestnut

European chestnut occurs predominantly in the forests of the southern regions of Russia. Its fruits are used fresh, fried, roasted, and boiled, and they are in great demand for confectionery purposes. Pure stands are rare, usually up to 30 % of stands containing chestnut are of oak, beech, hornbeam, and other species. Chestnut stands yield well and regularly from age 10–15 years onwards. Their total area in Russia is 48 900 ha and their productive area is 34 300 ha. The average yield capacity of chestnut is 200–250 kg/ha, while the total biological crop may amount to 4300 tons. These resources are exploited to the degree of 25–30 %, including no more than 10 % by commercial organisations.

Edible Mushrooms

Mushroom collecting is the most profitable and lasting of all the forest uses. *Pileus* (cap) mushrooms occur throughout Russia, from the very limit of vegetation in Arctic Ocean's islands to the steppe zone, and in all the forest types. They are at their most abundant in boreal forests, in the middle and southern taiga zones. Only 5–7 % of all known mushroom species are well-known and eaten. The yield capacity of the major species of edible mushrooms – per unit area – in different types of forest lands and different habitats rises to close to 70 kg per annum, including worm-infested mushrooms. Damage by insect larvae can amount to ca. 30 % depending on weather conditions and the mushroom crop. For purposes of computing the biological resources, the figure of 50 kg/ha is taken as being the average yield. This results in the figure of 4.1 million tons per year as the biological mushroom resource of the country as a whole. The figure includes 656 900 tons for the European-Urals part and 340 660 tons for the Asian part (Strakhov et al. 1995). The corresponding commercially accessible resource figures are 439 800, 171 500, and 268 300 tons.

Forest-based foodstuffs have always enjoyed great demand among Russians. Russia has exported them since long ago. According to sectorial statistics, the average annual exports of forest wild products in 1965–1976 were as follows: cranberry 1345 tons, cowberry 430 tons, dried bilberry 89 tons, wild nuts 1759 tons, honey 4574 tons, mushrooms 587 tons, plus the value of medicinal plants and vegetable raw materials for technical uses.

Cattle Grazing and Haymaking in Forests

Forest hayfields and meadows provide pastures for cattle (more than 30 % of the hayfields) and for domesticated reindeer (more than 50 % of the pastures). At present, the area of hayfields is ca. 2 million ha, and 52.4 % (1.04 million ha) of these hayfields lies within the EUPR. The average annual yield of hayfields in Russia is about 750 kg/ha. According to the FSA data for 1993, forest pastures occupy 17.5 million ha. Since 1956 the area of hayfields has diminished from 8 million ha down to 2.3 million ha (i.e. by 71.4 %), mainly at the expense of the Asian parts of Russia (where the corresponding area diminished by more than 75 %). Contrary to this, the area of pastures increased between 1956 and 1993 by 15 million ha, mainly at the expense of reindeer pastures. Only 2.3 % of the pastures are situated within the EUPR, the rest are in the Asian part,

chiefly in the Kamchatka Region (52.3 %), Yakutia (28.9 %), the Krasnoyarsk Territory (4.4 %), the Tyumen Region within its old borders (4.3 %), and Tuva (3.1 %). Thus, these five regions contribute 93 % of the national pasture area. Grazing is carried out both on dedicated meadows and in some open forests and grassy glades. Despite the distribution of the area of hayfields being more or less equal over the EUPR and the Asian parts of Russia, about 75 % of the total volume of harvested hay is carried out by the FMUs of the EUPR and this is explained by the region's higher population density and better accessibility of forest areas.

5 Hunting and Sporting Facilities Provided by Forests

Russian boreal forests are the chief habitats of the most valuable species of game animals. The boreal forests are home to the majority of professional hunters and trappers. Official statistics of Russia report that the total area of game habitats in the country in 1993 year was 1286 million ha, including 1076.7 million ha allocated to actual users. Of all the game habitats, those in the forests make 48.2 % (619.8 million ha). The share of the Federal Forest Service of Russia hardly exceeds 2 % (13.57 million ha, including 12.82 million ha specially allocated to users). More than 16 % of habitats are not allocated to actual users. This means that game management there lacks rules. In the Asian parts of Russia such lands amount to almost 20 %. The sound commercial development of such lands could improve the use and restocking of game resources.

One important issue needs a special mention. In many eastern regions of Russia, the forest stands are formed mainly of larch on sites of low site index and with a lot (30–40 %) of decaying trees. In these forests the value of secondary, non-wood products, including food and game, are much higher than that of felled timber. Therefore, it would be inappropriate, both economically and ecologically, if not to say detrimental, to allocate such forests for any kind of final felling.

If one compares the current numbers of some game species with the data for the period 1971–1978, one notes an increase in the populations of marten, hare, roe deer and wild boar. On the other hand, muskrat numbers have dropped by more than half. Such data should be taken into account when drawing up plans for game harvesting.

6 Conclusions

According to the data available to us, climatic conditions comparatively favourable for forest growth are to be found on 59 % of Russia's mineral soil lands (70 % within the EUPR). According to our estimates, 78 % of Russian territory may be referred to as being boreal forest land and more 87 % of Russia's stocked forest land is concentrated on this area.

During the period 1995–2005, the positive trends in Russian forest resources dynamics are expected to lead to increases in the area of coniferous young increment stands belonging to the 1st age class, as opposed to the trend of reduction of that area as outlined after 1983. As regards individual regions, such as the Karelian Republic, the North-West and Central Areas (including Kostroma and Yaroslavl Regions), the Kirov Region, the area of coniferous young increment stands belonging the 1st age class is expected to decrease. This trend is a result of the drain of accessible forest plantings, reductions in the area of wood harvesting, and the predomination of areas belonging to the 2nd age class as opposed to the sharp fall in reforestation (this especially applies to the fall in forest planting areas).

About 70 % of the total area covered by coniferous young increment stands belonging to the 1st age class lies in Siberia and the Far East.

It is expected that by the year 2000 the area covered by young increment stands will be transferred to the category of valuable stands and should exceed the clear-cut area provided that the projected silvicultural works are carried out completely. In addition, a considerable proportion of non-stocked forest lands (mainly in Siberia and the Far East) is situated in regions difficult to access in terms of timber growing, and such areas are actually used only as pastures. Some of the lands on which forests can not be grown should, in fact, be classified as being non-forestry lands, i.e. steep mountain slopes, peatlands with occasional pine, birch and other trees, etc.

It is necessary to ensure further acceleration of forest use by involving soft-leaved stands in the commercial turnover, especially in some of the EUPR regions. As regards hard-leaved tree species, the most probable development would be a slight (0.1 %) decrease in the proportion of the main timber species within the stocked forest area of the Asian part of Russia. Within the EUPR, a corresponding rise is expected.

By the year 2000, the average annual increase (no longer a loss!) of the stocked forest area of the main timber species (including conifers) is expected to amount to 0.14 % (over the whole country, as well as in the EUPR and in the Asian Russia) and respectively 0.73, 0.21 and 0.52 million ha (Strakhov et al. 1995).

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