Potential and market demand for food and non-timber forest products of the Russian forest

V N Petrov*, T E Katkova, Y V Dzhikovich

¹Department of Forest Policy, Economics and Management, Institute of Forest Business and Innovation, St. Petersburg State Forest Technical University, 5 Institutskiy Lane, St. Petersburg 194021, Russian Federation

*Corresponding email: vladimirpetrov@mail.ru

Abstract. Research of the food and minor resource potential of the Russian forest and market demand for these products has been done in the article. The objective of the work is to show an imbalance between the huge potential of food and other non-timber products and the limited demand for such resources. The subject of study is economic results of food and minor resources consumption of the Russian forest. The novelty of the research is that regularities are identified and development trends of demand for food and secondary resources of the Russian forest have been assessed. The demand is formed by supply and demand, on the one hand, by the national management system, forest legislation, traditions and customs, on the other. Harvesting centers of food and secondary resources of the Russian forest are shown. Measures are proposed to increase the efficiency of the use of food and minor resources of the Russian forest. The research results can be used by forest companies, scientific organizations. The research can be continued towards the inclusion of food and secondary resources of the Russian forest in the economic relations system in forestry at national and international levels.

1. Introduction

Forests in Russia cover more than 8 million km² or 20% of all the world's forests. To study the potential of food forest resources in such an area requires large human labor, time and finance. Food and minor resources of the forest are understood to be uncultivated plant biological resources of the forest. The article emphasizes food forest resources.

The efficient use of food and non-timber forest products can be estimated on the basis of complete and reliable information about their quantitative and qualitative indicators. There is no such information for today in Russia. Some large companies organize their own expeditions to identify places of growth and productivity of raw materials from which medicines are made. Foreign market size for food and minor resources of the Russian forest is quite large and tends to grow.

The issues of ecological and economic assessment of forests and various useful functions performed by forest ecosystems are addressed in the works of such Russian researchers as K G Gofman and A A Gusev [1], N A Moiseev [2], E P Smolonogov [3], N I Kozuhov [4], P T Voronkov [5], V N Petrov [6, 7] and other scientists.

Comparative analysis of approaches to determining the economic value of ecosystem services and biodiversity is presented in international studies [8].

The relevance and novelty of the research topic is defined in the great practical importance of food and non-timber forest products use, both for the Russian economy and for foreign consumers.
2. Methods and Materials
The theoretical background of the study was writings of domestic and foreign scientists on the use of food and secondary forest resources, normative legal acts regulating forest relations in the field of forest resources use.

Information base for the analysis and identification of trends has been data from the Federal State Statistics Service, reports of scientists at forest congresses, scientific publications, reference manuals, reports of the Ministry of Agriculture of the Russian Federation, the Federal Forestry Agency and other references.

The study is based on a systematic approach to the subject matter. Abstract-logical, statistical, economic-mathematical methods, as well as tabular and graphical techniques of visualization of research materials were used in the research process.

Microsoft Excel Software was used for information processing.

3. Results and Discussion

3.1. Influences on food and non-timber resource markets in Russia
Forest food and non-food resources can be divided into three main groups, presented in table 1.

| Forest resource group | Characteristics |
|-----------------------|------------------|
| Non-wood forest resources | Stumps, birch bark, bark of trees and shrubs, brushwood, woody forage, spruce, fir, pine paws, spruces and (or) other softwood for festive use, moss, forest floor, leaf litter, reeds, shrubs and bindweed, shrubs and boughs for weaving, foliage (leaves, needles and sprouts of softwood and hardwood) etc. |
| Food forest resources | Wild fruits, berries, nuts, mushrooms, seeds, birch sap etc. |
| Medicinal plants | Fresh-gathered plants for prevention and treatment of people and animals, as well as raw materials for pharmaceutical |

*by authors.*

Harvesting on the lands of forest fund of food and non-timber forest products is carried out by citizens for personal consumption, and commercial structures for industrial processing and further sale [9].

Non-wood, food and medicine markets are currently being developed for forest resource groups. In turn, there are segments within each market: berry, mushroom, cedar nuts, etc.

Markets for forest food and non-timber products depend on several key factors including: natural, economic, legal and social factors (table 2).

| Group of factors | Characteristic of factors |
|-----------------|---------------------------|
| Natural         | - yielding ability;      |
|                 | - seasonality of harvesting; |
|                 | - uneven spatial location of forest resources; |
|                 | - difficult access to forest areas for harvesting; |
|                 | - natural reproducibility; |
|                 | - migration of food and minor forest resources in the field; |
|                 | - etc.                   |
### Economic
- low level of development of legal markets for food and non-timber forest products;
- discrepancy between demand for forest resources and their supply at the regional level;
- the need for a large start-up capital;
- high-risk business;
- the need to diversify production and place it in different regions in order to redistribute risk from different events (bad harvest, forest fires, etc.);
- distance of gathering places from consumption centers and processing of food and minor forest resources;
- the need for an effective system for delivery of raw materials and its processing (forest food and non-food resources - perishable products);
- difficulties in forming a procurement network;
- high harvesting costs;
- high tax burden;
- low level of industrial processing;
- dependence of production capacities for processing raw materials on productivity;
- difficult credit terms;
- etc.

### Legislative
- unreasonable universality of legal regulation of all food and non-timber forest products harvesting;
- discrepancies and gaps in forest law;
- limited legal tools for harvesting food and secondary forest resources;
- poor quality of theoretical and legal characteristics of forest law;
- lack of compatibility criteria for different types of forest management;
- complex procedures for obtaining permission to harvest food and non-timber forest products;
- legal skepticism and legal education of citizens;
- relationship between mandatory and dispassionate rules;
- etc.

### Social
- reduction in working-age population;
- low motivation of local people to work;
- unemployment rate in forest villages;
- living standard and quality of life;
- mentality of the Russian population;
- competing interests of local citizens and forest tenants;
- lack of professional harvesters;
- etc.

* by authors.

In addition to the aforementioned factors it’s necessary to add the lack of clear coordination between departments at the federal level such as: Federal Forestry Agency, Ministry of Industry and Trade of the Russian Federation, Ministry of Agriculture of the Russian Federation, Federal Service for the Supervision of Natural Resources, Federal Service for Veterinary and Phytosanitary Supervision, Federal Customs Service, etc. All these departments deal with issues of food and non-timber forest products. The lack of clear coordination sometimes creates insurmountable departmental barriers preventing entrepreneurs from building of market relations.

### 3.2. Harvesting centers of wild-growing products
According to official statistics, the harvesting of food and minor forest resources is carried out mainly in the Southern, Ural, Far Eastern and Central Federal Districts in Russia. In accordance with the forest law, industrial harvesting of food and secondary forest resources is permitted on the terms of
lease conditions. The extent to which leased forest plots are used to harvest food and secondary forest resources in these federal districts is 39 to 99%. In the regions of the other federal districts, food and minor forest resources are used by 23-29%. According to official data, the degree of forests use for harvesting food and non-timber forest products in Russia is about 50%. From our point of view, these figures are overestimated.

The largest volumes of harvesting of food forest resources on leased forest plots account for 7.2 million kg of harvesting nuts, berries - 1.4 million kg, medicinal plants - 0.7 million kg, mushrooms - 0.5 million kg and birch juice - 0.4 million kg. Mushrooms, berries and birch sap are mainly harvested in the European part of Russia, and nuts - in Asian.

Almost 1 million hectares of forests are leased for gathering and harvesting of food and non-timber forest products. Coniferous trees are mainly harvested here for the New Year and Christmas holidays. The harvesting of spruce or other softwoods based on sale and purchase contracts is limited.

Wild-growing nut plants having the main commercial value include Siberian pine (Siberian cedar), Korean pine (Korean cedar) and low pine (cedar prostrate). The seeds of these woody plants are commonly known under the general title “cedar nut”. Total area of cedar plantations in the country is 38.9 million hectares, of which 11.8 million hectares belong to protective forests including the area of nut harvesting zones is 6.5 million hectares. About 7.6 million hectares of cedar forests belong to reserved forests.

There are cedar forests in 32 constituent units of the Russian Federation, but also all of these are located beyond the Ural. According to the state forest register, the area of cedar forests of the Ural Federal District is 7.3 million hectares, Siberian - 28.3 million hectares, and the Far East - 3.3 million hectares. The largest area of cedar forests and the maximum reserve of cedar in the Krasnoyarsk Territory is 9682 thousand ha, in the Irkutsk Region - 6911 thousand ha, in the Tomsk Region - 3656 thousand ha, the Republic of Tyva - 3231 thousand ha. Russia is the world leader in terms of cedar planting. But despite a huge raw material base and rising cedar nut prices, Russia ranks last in these exports.

The price of pine nuts is largely determined based on its size, which, in turn, depends on pine nut location. Cedar nut growing on Altai is believed to be the smallest and therefore the cheapest. Siberian is a medium in size and price, and the largest and most expensive is Far Eastern cedar nut. According to the “Union of Wild Growing Products Processors” (Novosibirsk), the average market price of inshell cedar nuts for 19 years has been 3.26 dollars/kg, the average annual absolute increase - 0.17 dollars/kg (figure 1). Against the background of general trend of rising prices for pine nuts, it is possible to note their sharp increase in some years and a decrease, due to cyclical nature of the harvesting. For example, in the 2011 harvest year, the supply exceeded demand that led to a decrease in prices, and, conversely, in 2008, when pine forests did not give fruit the price of nuts increased.

There are about 3,000 species of cap mushrooms in total in Russia, of which more than 200 species are suitable for eating. According to the Federal Forestry Agency, the total mushroom-bearing area is 81.8 million hectares, including 64.1 million hectares in the Asian part and 17.7 million hectares in the European-Urals. The biological reserve is 4.3 million tons, which is mainly concentrated in the Asian part - 3.5 million tons, the European-Ural part accounts for only 0.8 million tons. About 40 species of birch grow in Russia. The largest reserves of birch sap are concentrated in the Siberian (42.4%), Ural (21.7%) and North-West (15.5%) federal districts. There are more than 12 thousand species of medicinal plants in Russia. According to the Federal Forestry Agency, currently in scientific medicine it is allowed to use about 200 plant species, 65% of which are wild-growing. Despite the increase in biological reserves of some food and non-timber forest resources (birch sap, nuts), the harvesting of wild fruits and berries has significantly decreased since 1999.
Figure 1. Prices dynamics for inshell pine nuts from 2001 to 2019, dollar/kg (by data of Noncommercial Partnership “Union of Wild Growing Products Processors”).

There is a penetration of forest food products from abroad on the domestic food market. Foreign medicines begin to crowd out domestic ones on the market of medicinal plants.

3.3. Types of markets of wild-growing products
At present, two types of markets for food and non-timber forest resources are developing concurrently: legal and illegal.

The illegal market is usually local, with participants limited to gathering forest resources and selling them at recycling centers of food and minor forest products or processing them at home and then selling them privately. There is no reliable information on the amount of food and non-timber forest products sold on it. One can only assume that they exceed the volumes of harvested and sold food and minor forest resources in the legal market. Citizens harvest food and non-timber forest products and deliver them to recycling centers after which the products come to wholesalers or directly to the production, where there are special premises for their storage, sorting, freezing and processing.

The legal market of food and non-timber forest products is underdeveloped, and main reason lay in the economic and legal sides, as well as lack of reliable information on location, quantity and quality of these resources.

3.4. Radiation risks in gathering of wild-growing products
Part of the forest fund land is contaminated by various radioactive materials such as pollutants, radionuclides, pesticides, nitrates, heavy metals.

A large number of Russian citizens are engaged in harvesting of food and non-timber forest products. Volumes of these harvested products are not taken into account by official structures. In most regions, population is not sufficiently informed about places of forest pollution with radionuclides as a result of accidents at the Chernobyl nuclear power plant, at the production association “Mayak”, tests of nuclear weapons at the Semipalatinsk field.

Partial radioactive pollution has been observed in some areas of the Bryanskaya, Kaluzhsksaya, Oryol and Tula regions due to the disaster at the Chernobyl nuclear power plant. Zone of residence with preferential socio-economic status includes some territories of the Republic of Mordovia, Belgorodskaya, Bryanskaya, Voronezh, Kaluzhsksaya, Kursk, Leningrad, Lipetskaya, Oryol, Penza,
Ryazan, Tambovsky, Tula and Ulyanovsky regions [10]. Forest areas contaminated by the accident at the “Mayak” production association in 1957 include forest lands of Chelyabinsk, Sverdlovsk and Kurgan regions. Nuclear weapons tests at the Semipalatinsk test site affected territories of the Altai Territory and the Altai Republic.

3.5. Consumer markets for food and non-timber products
The markets of food and minor forest resources are heterogeneous of their consumption pattern. For example, the market of medicinal plants is focused on foreign market. The market of food resources is targeted both on external and domestic. Rate of return in markets of food and non-timber products depends on supply and demand in a particular region. For example, a mushroom segment is considered more cost-effective than a berry one.

Entrepreneurs of the Far Eastern Federal District gravitate towards the Japanese and Chinese markets for food and secondary forest resources, where they mainly sell raw materials, and processing is carried out abroad.

The North West region uses 23% of the forest area made available for use to collect food and secondary forest resources. But in terms of actual volumes of harvested resources the North-West Federal District occupies one of the first places, both on domestic and on external market. The region has sufficient capacity to store and process food and minor forest resources. This is due to the advantageous geographical position towards Scandinavian, Baltic and other European countries with traditionally high demand for by-product forest management.

The Siberian federal district is rich in food and minor forest resources. But entrepreneurs need to organize deep processing of forest resources in the field, and with high added value, and subsequent sale, both in the domestic and external markets, because of region distance from foreign markets and excess supply over demand of forest products. Berries and mushrooms from Siberia are in demand in European countries, in America, Canada, Australia and China.

Forests of the Central Federal District are not rich in forest resources, but the region has modern infrastructure and production facilities for processing almost any types of products. Domestic market of the district is characterized by large capacity and high demand for by-product forest management, so cooperation with entrepreneurs of the North-West region is established.

3.6. Challenges of forest food and non-timber products harvesting
Availability of food and secondary forest resources and demand for them in the domestic and foreign markets with a low level of their harvesting and processing creates many problems, the solution of which lies in socio-economic and legal challenges.

The results of this research allowed to systemizing and summarizing the following socio-economic problems.

The lack of integrated assessment methodology for forest plots and valuation of property rights arising from forest use in order to harvest food and secondary resources reduces effective management of these activity types.

Despite low minimum rent rates, for some types of food forest resources in regions, the procedure of obtaining a forest field remains difficult to be done for the local population and entrepreneurs. The population avoids formal contractual relationships with state forest authorities.

Decrease in the number of working age population in forest villages, lack of motivation and deskillling in harvesting food and secondary forest resources in industrial volumes significantly complicate organization of enterprises for commercial production.

The results of this study allowed to generalizing and systematizing legal problems.

Forest legislation allows citizens to stay freely on forest fund lands and collect wild fruits for their own needs, i.e. use of forest resources for non-commercial purposes. There is no reliable data on the real volume of harvesting of forest products by citizens for their own needs. Commercial harvesting of food and secondary forest resources can be carried out after conclusion of forest lease agreement based on auction results.
Practice shows these conditions are difficult for population and small and medium-sized businesses.

The main reasons for complication of legal access to forest resources for entrepreneurs are:
- long procedure for obtaining the right to use forest area for commercial purposes and a large amount of start-up costs (towards 7,746 US dollars) for preparation of documentation (forest development project, expertise, annual forest use report), as well as other obligatory procedures are to be done;
- the complexity due to maintaining of leased forest plot such as preparation and submission of the annual forest declaration, fire-fighting management, sanitary measures, temporary facilities, forest field renovation, road maintenance and parking, etc.;
- long-term of minimum forest lease period;
- annual payment system not accounting harvesting seasonality, yield (from 50 to 100 kg/ha), climatic conditions creates additional financial burden on forest users;
- harvesting of food and minor forest resources in practice is carried out with an annual change of forest plots at defined time while the rent based on all area is calculated for the whole year;
- population transfer of food and non-timber forest resources to harvesting points is classified as commercial activity to be declared;
- processors of food and secondary forest resources do not own farmer status, which makes it much more difficult to obtain bank credit;
- after rental the fields for harvesting food and minor forest resources, it’s allowed citizens to gather forest resources for their own needs, which lead to conflict of interest, etc.

The alternative to obtaining medicines on land plots have become their artificial cultivation on land and in personal household plots. Not all the reasons for the decline in industrial attractiveness of forest use types under consideration and the loss of State profits from loss of funds to the State budget are mentioned above.

4. Conclusion
In order to ensure the balance supply and demand in food and non-timber forest products market, it is necessary:
- address administrative barriers for forest business, which will lead to an increase in the volume of harvesting food and secondary forest resources;
- introduce short-term licences (up to a year) for the harvesting of food forest resources and the gathering medicinal plants taking into account the geography of their location and biological characteristics;
- allow the forest village citizens to sell food and secondary forest resources by cash;
- delineate forest areas for harvesting food and minor forest product for citizens (public forest areas) and entrepreneurs (licensed forest areas);
- adapt the rent system for entrepreneurs to seasonal conditions;
- continue research on fertility, yield assessment, biological and commercial stocks of food forest resources;
- provide special forest areas for the maintenance of rare and endangered medicinal plants.

References
[1] Gofman K G and Gusev A A 1977 Environmental protection (Environmental Management Models)[in Russian – Ohrana okruzhayushchej sredy (Modeli upravleniya chistotoj prirodnoj sredy)] (Moscow: Publishing Office “Economics”) p 230
[2] Moiseev N A 1993 Managing of multi-purpose forests [in Russian – Kak hozyajstvovat’ v lesah mnogocelevogo znacheniya] Forestry 6 pp 5-9
[3] Smolonogov E P 1994 Forest formation process and its features [in Russian – Lesoobrazovatel'nnyj process i ego osobennosti] Ecology 1 pp 3–9
[4] Kozhuhov N I 1998 Sustainable management of forest sector of the Russian economy in the
context of contemporary problems [in Russian – Ustojchivoe upravlenie lesnym sektorom ekonomiki Rossii v kontekste sovremennyh problem] Lesnoj vestnik 3 (4) pp 18-25

[5] Voronkov P T 2000 Payments for forest resources in the twenty-first century [in Russian – Platezhi za lesnye resursy v XXI veke] Lesnoj ekonomicheskij vestnik 4 pp 33–34

[6] Petrov V N and Katkova T E 2018 Comparative analysis of economic indicators of forestry in Russia and Finland [in Russian – Sravnitel'nyj analiz ekonomicheskikh pokazateley lesnogo hozyaistva Rossii i Finlyandii] Economic gazette of the Higher School of Economics. vol 22, 2 pp 294–319

[7] Petrov V N 2016 Economic and legal regulation of wild-growing products harvesting in Russia [in Russian – Ekonomiko-pravovoe regulirovanie zagotovki dikorosov v Rossii] Lesprominform – Professional woodworking journal Lesprominform 4(118) pp 122-128

[8] Haines-Young R H and Potschin M B 2009 Methodologies for defining and assessing ecosystem services. Final Report, JNCC, Project Code C08-0170-0062. p 69 Available at: http://www.nottingham.ac.uk/cem/pdf/JNCC_Review_Final_051109.pdf.

[9] Rules of preparation and harvesting non-timber forest resources: approved by the Order of the Ministry of Natural Resources and Environmental Protection of the Russian Federation of 16.07.2018 No. 325 "About the approval of Rules of preparation and harvesting non-timber forest resources" [in Russian – Pravila zagotovki i sbora nedrevesnyh lesnyh resursov: utverzhdeny Prikazom Minprirody Rossii ot 16.07.2018 № 325 «Ob utverzhdenii Pravil zagotovki i sbora nedrevesnyh lesnyh resursov» (Zaregistrirovano v Minyuste Rossii 10.08.2018 № 51845)] Available at: http://www.consultant.ru/document/cons_doc_LAW_304605/

[10] Resolution of the Government of the Russian Federation No. 1074 of 08.10.2015 "On Approval of the List of Settlements within the Boundaries of Radioactive Contamination Zones as a Result of the Chernobyl Nuclear Power Plant Disaster" [in Russian – Postanovlenie Pravitel'stva RF ot 08.10.2015 № 1074 «Ob utverzhdenii perechnya naselennyh punktov, nahodyashchihsiy v granicah zon radioaktivnogo zagryazneniya vsledstvie katastrofy na Chernobyl'skoj AES»] Available at: http://www.consultant.ru/document/cons_doc_LAW_187310/