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CONTINUOUS AND SUSTAINABLE FOREST EXPLOITATION – FUNDAMENTAL PRINCIPLE OF THE ORGANISATION OF FOREST USE AND FOREST MANAGEMENT

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The main feature of forest growing, which distinguishes it from other types of economic activity, is an extremely long production cycle, measured, e.g., for coniferous species of the temperate zone, over many decades. This distinguishing feature imposes an obligation to commensurate use of forest resources with the timing and scale of their reproduction. This is the essence of the principle of continuous and sustainable forest exploitation. The aforementioned fundamental principle defines the conditions for streamlining forest exploitation and organisation of forest management.

With the seemingly obvious essence of this principle, the history of forest husbandry, up to the present moment, retains traces of various definitions of its name, application subjects and measurement or control indicators [7]. Expansion of the goals of forest exploitation and changes in its structure have further complicated interpretation of the essence of this principle, which determines the relevance of the issue that has been raised [1, 11, 12].

The principle of continuous and sustainable forest exploitation was originally introduced into forest husbandry under the name of the principle of constancy of forest use [8, 10, 13], which

meant continuous forest exploitation over time, as opposed to periodical or temporary forest exploitation. Yet forest exploitation can be continuous and, at the same time, so uneven that it causes complications in wood sourcing and disrupts the regular operation pattern of forestry enterprises. Consequently, the concept of this principle was extended to include constancy and uniformity of forest exploitation [6, 8]. It was meant that, when calculating average forest exploitation over a more or less prolonged period of time, the volume of timber harvesting should not vary greatly, although it may differ for individual years.

The demand for wood and other forest resources is, however, continuously growing. In order to satisfy these growing demands, special measures aimed to ensure enhanced reproduction of forest resources should be introduced or have already been introduced in forestry management practices in a number of countries. In this context, it is obvious that the constancy and uniformity of forest exploitation is insufficient as a basic principle. Explanations are being made that "constancy" should also be understood as "optimality" [13]. Such an understanding of "constancy", although it relates to multi-purpose forest management, does not cover the level of reproduction of forest resources in view of the ever increasing demands for them.

The above limitation of the concept of "uniformity" is alleviated by the concept of "sustainability" [2, 3, 9]. The principle of sustainability predetermines exploitation of forests in accordance with their purpose, which ensures sustainable forest exploitation potential throughout the entire logging cycle. At the same time, forest exploitation can be both relatively even and progressively increasing, depending on the extent of reproduction of resources, taking into account the goals set for forestry enterprises. Sustainable forest exploitation cannot be decreasing over time; it retains the accumulated potential for an arbitrarily long period. In this sense, sustainability means the obligation to pass the forest fund on to future generations in such a way that the achieved forest exploitation potential will be preserved even for our grandchildren.

The concept of sustainability ensures continuity, that is, constancy of forest exploitation. But for historical consistency, both terms are preserved and are used together in our country. The principle of continuous and sustainable use of forest exploitation was included in the "Fundamentals of Forest Legislation of the Union of Soviet Socialist Republics" as a basic requirement on forest management.

It is believed that the continuity and sustainability of forest exploitation is a concept of a temporal order. This opinion is associated with the main feature of forest growing: its duration, reflected by such indicators as exploitability age and logging cycle. Yet, in order to characterise

this concept more fully, it is necessary to consider it in connection with another, broader concept: reproduction of forest resources [4].

The very notion of reproduction itself implies continuous resumption of production. With regard to the resources extracted from the forest annually, this means the need to conduct an annually recurring system of economic measures in a scope ensuring their reproduction.

For example, let us imagine economically developed forests of a forestry enterprise that conducts timber harvesting within the limits of a designed wood cutting area, which reflects the possibilities of forest exploitation.

In order to maintain the achieved level of timber harvesting over a prolonged period of time (continuously), it is necessary to conduct a set of interrelated activities corresponding to the nature of the forests and the economic conditions of the area, including, along with the established method of logging, related methods of reforestation, care for young stock, measures to protect forests from fires and pests, etc., as well as to possess the required financial, material, technical and labour resources. Such an integrated set of forestry-based, technical and economic measures, consistent with the zone-typological and economic conditions, can be referred to as regional systems. They are developed by scientific and design institutions for various areas of the country. Implementation of such regional systems is designed to balance the withdrawal and reproduction of forest resources and thus practically ensure continuous and sustainable forest exploitation, but only at its lowest level, that is, in constant or relatively uniform amounts.

Disruption of harvesting and reproduction of a particular resource, due to, for example, forestry lagging behind forest exploitation, or in case of unbalanced forest usage, violates the requirements for continuous and sustainable forest exploitation, with all the resulting economic and sometimes environmental consequences.

However, progressive forestry development is designed to ensure the satisfaction of continuously growing demand both for the resources of each specific type and for the expansion of their assortment. In this case, we are dealing with the organisation of reproduction of forest resources on an extended scale designed to ensure continuous and progressively increasing multi-purpose forest exploitation. Dynamic balancing of the expanding scale and diversity of production and consumption of forest resources and services is possible only within an extended time frame and requires development of a target-driven long-term forest policy. In the USSR, the process of expanded reproduction of forest resources is managed using pre-developed long-term forecasts and a system of plans – for 10–15 years, for 5 years and annual plans – for development

of the entire complex of forest industries (including forestry), taking into account the objectives of the national economy.

An integral part of the problem of meeting the growing demand for wood and some other forest resources is the international trade in forest materials, whose scale has increased with the development of interstate contacts. This trade plays an important role for the economies of individual countries.

Expanded reproduction of forest resources within the country is carried out with application of a set of measures to increase forest productivity (intensive method), as well as with use of previously undeveloped forests and afforestation of land in forestless or low forest areas (extensive method). These activities require additional investments with long-term returns. Their priority is determined by national economic efficiency and their volume is determined by the economic possibilities of the country at each stage of development. In the USSR, the scope of such activities is provided for by the plan. The intensification of forestry, aimed at increasing the productivity of forests, is accompanied by a continuous increase in costs per unit area, followed by an increase in the volume of forest products and a reduction in their costs.

Continuity and sustainability of forest exploitation is thus not only a concept of a temporal order. In terms of reproduction, it has a specific economic content, whose tangibility is determined by the economic level of forest management.

It is of fundamental importance that spatial boundaries are established for application of the requirements of continuity and sustainability of forest exploitation, and indicators that can be used to monitor their implementation are developed.

The question of the primary, initial application subject of the principles of continuity and sustainability of forest exploitation is significant because it serves as a basis for development of systemic business decisions, which form the core for planning and organising economic activity of forestry enterprises, since the forestry enterprises themselves must function on the basis of the principles of continuity and sustainability of forest exploitation. It is necessary to have cognisance of the optimal area of such enterprises and structural units to which the principles of continuity and sustainability of forest exploitation must apply. In principle, the size of the application subject of the principles of continuity and sustainability of forest exploitation is determined by the economic possibilities of the relevant organisation. This, in turn, is determined by a number of interrelated factors: the purpose of the forests, forest cover percentage, forestry intensity level, specialisation and concentration of production based on development of forest resources. In this

case, two opposite trends interact with each other: on the one hand, the intensification of forestry deepens the differentiation of the application subject, which to a certain extent narrows its size; on the other hand, the efficiency of production is influenced by the degree of concentration of production facilities, which, at a certain level, ensure the effective specialisation within the framework of intra- or inter-organisational cooperation. Yet both trends are subject to environmental and social constraints in each area. Given the large variety of natural and economic conditions, the area of forestry enterprises may be different, while maintaining the general trend, which determines a decrease in the area of intensive forestry enterprises and an increase in that of extensive forestry enterprises.

According to the officially approved method, the subject for calculation of forest exploitation is a separate forestry enterprise (forestry administration). In practice, even nowadays, not all such enterprises (not to mention timber industry enterprises, especially in heavily forested areas) ensure compliance with the principles of continuity and sustainability of forest exploitation. The majority of timber industry enterprises had been formed earlier as periodically operating or temporary ones, which complicates a prompt transition to country-wide application of the principles of continuity and sustainability of forest exploitation.

The task of forming permanent timber industry enterprises was formulated in the resolution of the Central Committee of the Communist Party of the USSR (CPSU) "On the work of the USSR Ministry of Forestry and Woodworking in increasing the efficiency of wood use in light of the requirements of the XXV Congress of the CPSU" (1976). The "Basic Directions in the Economic and Social Development of the USSR in the years 1981-1985 and in the period up to 1990" contain provisions for ensuring a gradual transition to forest management applying the principles of continuous and sustainable forest management, for commencing implementation of a targeted integrated programme for creation of a permanent forest raw material resource base for the pulp and paper industry in the European-Urals zone of the USSR.

The very formulation of the task of creating permanent timber industry enterprises and a permanent forest raw material resource base for the pulp and paper industry suggests that, as of today, it is not possible or feasible to ensure implementation of the principles of continuous and sustainable forest management for every forestry and timber industry enterprise. A gradual country-wide transition to implementation of the principles of continuous and sustainable forest management will apparently be performed on a phased basis. The sequence of stages will consist in streamlining forest exploitation first within the framework of large territorial production

complexes, then within the raw material bases of the large timber industry complexes comprising them and only after that within individual forestry and timber industry enterprises. This sequence is due to the fact that the raw material bases of a number of timber industry enterprises are already so depleted that it is too late to talk about implementing the principles of continuous and sustainable forest management at this stage. Even so, it is important to prevent extreme depletion of consumer raw material bases of timber industry complexes, which include these timber industry enterprises. Such a danger exists, for example, for the Bratsk Timber Industry Complex and it is important to correct the shortcomings that have developed here promptly. Combining the efforts of the Ministry of Forestry of the USSR and the Ministry of Paper Industry of the USSR will make it possible to change the situation that has developed in this timber industry complex. Under the new conditions of unified management of the complex of timber industries, it will finally be possible to subordinate the logging industry (which until now occupied an unjustifiably privileged position among forest sectors) completely to the interests of wood working and processing industries and, consequently, to subordinate the entire forest exploitation sector to the requirement for creation of permanent raw material bases of timber industry complexes and the pulp and paper industry enterprises incorporated in them.

The question arises about the feasibility and possibility of implementing the principles of continuous and sustainable forest management in the territorial and economic units that make up the relevant enterprises. This issue is fundamentally important only in terms of meeting the system of forest management requirements, especially those that are caused by social and environmental constraints. This means, for example, the permissible degree of concentration of forest cutting areas, especially clear-cutting ones, in one part of the enterprise or another taking into account the specific combination of forest categories and types. In the event that social and environmental constraints do not dominate, it might be advisable to concentrate logging areas and, as a result, to eliminate the irregularity of their volume and allocation within the enterprise with regard to its structural units.

At the same time, the predominance of purely protective forests, especially in mountainous areas, will require a more even distribution of logging areas throughout the territory, which weakens anthropogenic impacts on the functioning of the ecological system as a whole.

As for lowland areas, especially those with dense forests, where logging does not significantly disturb the hydrological regime and does not lead to soil erosion, it is often advisable to place logging areas in blocks but, of course, with a differentiation of logging methods with

regard to forest categories. It should be borne in mind that, as the number of forest categories in a given enterprise increases, implementation of the principles of continuous and sustainable forest management for each of them can lead to such a deconcentration of logging areas that it becomes difficult or even economically impossible to perform logging with regard to certain forest categories. In some categories of group I, for instance, the calculated felling rate is systematically not used. So implementation of the principles of continuous and sustainable forest management for each category of forest within a forestry enterprise is necessary only when it is dictated by social and environmental constraints.

The next important economic division within the enterprise is the working circle, which means the totality of forest areas with common economic characteristics and purpose. A working circle is traditionally considered as the main subject for implementation of the principles of continuous and sustainable forest management. This tradition is connected with the theory of normal forest, one of the attributes of the scheme of which is uniform distribution of the area of forest stands by age class within the logging cycle. Yet the scheme of a normal forest in its classical sense is implemented only if the purpose, conditions and methods of forest exploitation remain unchanged, with the structure of the forest fund established once and for all. The forest fund could approach the scheme of a normal forest at the level of simple reproduction of forest resources.

With the expanded reproduction of forest resources and the growing multi-purpose exploitation of forests, there is a gradual change in the ratio of goals and their priorities, which, in the long run, seriously affects the structure of the forest fund. In the process of forestry intensification, unproductive forest stands are replaced by more productive ones and the ratio of working circles also changes. Some working circles (unproductive ones) can disappear altogether, being replaced by more productive ones. With such a dynamic restructuring of the forest fund in the process of expanded reproduction of forest resources, not every working circle can represent a consistent subject for implementation of the principles of continuous and sustainable forest management.

In the context of dynamic development of the forest fund, when calculating the principles of continuous and sustainable forest management, all working circles should be considered systemically in an integrated way, with identification of functionally different groups, whose further extension areas increase, decrease or remain relatively stable.

With the expanded reproduction of forest resources, ensuring continuous, progressively

increasing multi-purpose forest exploitation, the normal forest scheme is not suitable for ensuring compliance with the principles of continuous and sustainable forest management. With a changing ratio of areas and stocks of forest stands over time, a reliable regulator of compliance with the principles of continuous and sustainable forest management cannot be expressed by only traditional indicators of the forest fund, such as the distribution of the area and the stock with regard to age class or growth (current or average periodic). Under these dynamic conditions, in order to ensure reliable implementation and monitoring of compliance with the principles of continuous and sustainable forest management, they must be supplemented with the calculated permissible exploitation rate for a certain resource in the long-term in the form of a temporal resource flow over time stages. The exploitation rate, e.g., of wood within a logging cycle, makes it possible to assess the long-term consequences of the existing exploitation level or proposed management alternatives with regard to future periods.

The balance method of forecast calculations of forest exploitation based on long-term forest resources reproduction programmes, which was developed for this purpose, allows the exploitation rate to be determined of a certain resource, including wood, at different levels of forest management, the long-term consequences of economic decisions made and their effectiveness, the formation of the structure of the most effective long-term programmes for management of long-term expanded reproduction of forest resources [5].

Even so, with the different quality of wood within various working circles, quantitative indicators of cumulative forest exploitation do not sufficiently characterise the level of continuous and sustainable forest management for one subject or another as a whole. So, alongside the natural indicators, cost indicators must be used: wholesale prices for wood of different species and assortments, net profit (difference in wholesale prices and the cost of assortments), as well as the efficiency of reproduction of the tree resource in the form of the ratio of profit to reduced expenditures or to costs of production. With regard to the above, the requirement for compliance with the principles of continuous and sustainable forest management will be fulfilled provided that a continuous cumulative flow of the whole complex of resources, which can be valuated, will not decrease in terms of value in the long term for the facility as a whole (the forestry enterprise).

Monitoring of compliance with the principles of continuous and sustainable forest management can thus be carried out in various ways, depending on the scale of reproduction: for simple reproduction of forest resources – on the basis of distribution of area and stock of working circles by age class using the scheme of normal forest and for expanded reproduction – by

supplementing traditional indicators with the characteristics of cumulative forest exploitation (throughout the entire logging cycle) in physical and monetary terms.

What has been said about monitoring of compliance with the principles of continuous and sustainable forest management refers mainly to one, albeit the most important, forest resource – wood. The problem of determining the scope of multi-purpose forest exploitation is still only on the agenda for future scientific research. It will require an initial search for a methodological approach to solving this problem. Preliminarily, we can only say that the fundamental difference in its solution will not be maximisation but optimisation of exploitation of each individual forest resource, while maximising the cumulative effect in multi-purpose forest management, taking into account the given structure of goals. Yet a programme-target basis, which also presupposes a linkage between multi-purpose continuous and sustainable forest management and the scale and structure of expanded reproduction of forest resources, will be common for the solution to be developed.

The dynamic feature of forestry objectives will naturally lead to a change in the structure of forest management. Then the question might arise as to whether maximising the cumulative effect at a certain stage can lead to a reduction in the amount of wood utilisation and, consequently, to a violation of the principles of continuous and sustainable forest management in relation to wood resources. This question deserves close attention. The matter is that the share of social and ecological functions of the forest is continuously increasing over time. Even today, forests of group I, in which protective functions take priority, already account for a significant share in sparsely wooded areas of our country. These functions in aggregate undoubtedly affect wood utilisation. Under these conditions, compliance with the principles of continuous and sustainable forest management with respect to wood can be ensured by expanding the scale of cutting methods that meet the purpose of protective forests but require more labour and resources than cutting methods applied in industrial-purpose forests. This refers to various kinds of selective, gradual, reconstructive, landscape felling, etc. So there is a need for additional resources for intensification of forestry, which ensure not only withdrawal of the wood by appropriate cutting methods but also its reproduction in compliance with more difficult exploitation methods, which are more strictly regulated by forest management requirements.

Consequently, under the conditions of multi-purpose forest management, which is aimed at maximising the cumulative effect of all forest resources, continuous and sustainable exploitation of forest resources can be ensured only through the intensification of forest management, which

requires a significantly higher level of expenditure compared to reproduction of wood in production forests. Intensification of multi-purpose forest management becomes a condition for ensuring compliance with the principles of continuous and sustainable forest management and satisfaction of the continuously growing demand for various forest resources.

Under the conditions of the continuously growing demand for a variety of forest products and services, the role of forest management in development of programmes and projects ensuring management of the long-term process of expanded reproduction of forest resources is likewise increasing. Control over implementation of the principles of continuous and sustainable forest management and its systematic regulation at different levels of reproduction of forest resources is an essential part of such programmes and, consequently, of the entire forest management sector. Pursuant to the "Fundamentals of Forest Laws of the USSR and Union Republics", the forest management sector is entrusted with the mission of state accounting of forests using a unified country-wide system, development of tasks for organisation of continuous, sustainable and rational use of forests for systematic satisfaction of the demands of the national economy for wood and other forest products, as well as development of a system of measures to ensure restoration and improvement of forest productivity and protection and preservation of forests. All the activities of the forest management sector in this direction serve not only the goals of current economic activity and economic development. At the same time, they expresses our concern for the future, for providing future generations with natural resources and benefits. Considering that a significant part of the effect obtained from implementation of these developments is aimed at the distant future and intended for those who will live after us, performance of these activities is an ethical commitment to the future of humanity.

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