Sustainable development and environmental situation in forest resources of the Central Black Earth region

A E Krupko*, Yu A Nesterov, R E Rogozina and M V Derevyagina
Voronezh State University, Universitetskaya pl. 1, Voronezh, 394018 Russia

* E-mail: glomer-a@mail.ru

Abstract. The aim of the work is to identify geographical features, factors and problems of forest resources of the Central Black Earth region and their impact on the sustainable development of the region. Low forest cover of the territory with long-term degradation of forest resources, low level of reforestation is characteristic of the Central Black Earth Region, which requires in-depth analysis of factors and trends in the development of forest management of the region. Results. The analysis of the development of forest management shows how difficult the environmental situation with forest resources of the district is. The main indicator is the forest cover of the territory in the CCR does not reach 9%. At the level of municipal districts, it is often 1.5-3%, which indicates an environmental disaster. Taking into account the trends and features of modern nature management, on the basis of our work we can conclude that the great degradation and reduction of forest resources determines the crisis, and in many places the catastrophic state of nature, which determines the need for transition to the expanded reproduction of forest resources - simple forest conservation is no longer enough.

1. Introduction
The global degradation of the natural environment caused the emergence of the concept of sustainable development, which implements many approaches to the study of nature and social systems. Gradually a bias to the study of sustainable socio-economic development appeared, so there are already more than a hundred definitions of the very concept of "sustainable development" [1]. Its versatility has led to an unacceptable departure from the main goal (optimization of nature management) to the predominant socio-economic development. Thus, the "Sustainable Development Goals" (SDGs) (SDGs) by 2030 only three goals out of 17 (13, 14 and 15) are directly aimed at improving the natural environment. It is clear that economic development currently determines the level and quality of life of people. But in some regions even this process is threatened by excessive degradation of nature. The formation of this concept in our country was superimposed on the transition to a market economy. In the crisis years of the 90s, when many socio-economic problems emerged, it is quite acceptable and understandable. In the present period of the existence of the country and its regions, the time has come when it is necessary to return to the study of sustainable development as such a development in which the conservation and improvement of nature is achieved. Otherwise, despite the growth of production, income, employment of the population, it will be generally destructive for the development of natural and social systems, which is now happening in the Central Federal District [2]. In our opinion, among the definitions of sustainable development we can give the following one - socio-economic development, which provides improvement or, at least, not deterioration of the environmental situation. Usually, it can be accepted in the case of a satisfactory situation [3]. In the CCR, however, there is a widespread deterioration at the
regional level (there are sometimes positive trends at the local level). In recent years, there has been a widespread transition to ecological disaster or its precursor, both in many ecosystems and for certain types of natural resources.

For sustainable nature management, the forest has the most diverse influence. Forests retain moisture, retain snow, which regulates water ecosystems. They also have a great soil-protective value and soften the climate. Forest plantations improve the comfort of human habitation. Taken together, forests have a decisive influence on the state of the natural environment.

The aim of the work is to assess the condition and ecological situation of forest resources and their role in achieving sustainable development of the Central Black Earth region.

2. Materials and methods

In order to fulfill the goal, we used comparative, structural-systems, statistical, graphic and analytical methods of research. The analysis of information from open official publications of state statistical authorities of the country and regions, forest plans of the regions of the Central Chernobyl region was carried out. The data were summarized, systematized and analyzed in this scientific study, which was implemented in writing the article.

The Central Black Earth region occupies the southern (mostly forest-steppe and steppe) part of the CFD. The state of the natural environment in all zones (from forests in the north of Kursk and Tambov regions to steppes in the south of Voronezh and Belgorod regions) has undergone radical transformation during the time of anthropogenic use. Since the CCR is characterized by chernozem soils, its importance is extremely high for food supply of the Central Federal District and the whole country. The district occupies only about 1% of the RF territory, but it accounts for almost 5% of the population and 10% of the sown areas, more than 15% of the country’s agricultural output [2]. There are almost no fully preserved landscapes in the district. Even century-old oak forests are not natural, and many pine forests were planted 60-70 years ago.

The difficult situation in forest use of the area is determined not only by modern anthropogenesis. Back in the second half of the XIX century, the high density of rural population caused a super high proportion of arable land (about 80% of the area of the CCR) at the expense of deforestation, reduction of hayfields and pastures, water protection zones. The forest area in Chernozem Region has decreased from 5 mln ha (about 30% of its territory) to 1.45 mln ha - 8.8%. The reduction of forests together with the general increase in aridity of climate and rise of the territory caused approximately halving of small rivers network and considerable erosion. Great degradation and reduction of forest resources determine crisis and, in many places, catastrophic condition of the nature, which stipulates the necessity of transition to expanded reproduction of forest resources - simple conservation of forests and other natural elements is not enough. Therefore, it seems to us quite relevant to assess the level of anthropogenic impact, restoration and degradation of forest resources of one of the most important food regions of the Russian Federation.

3. Results and Discussion

The Central Black Earth Region is one of the sparsely forested areas of the Russian Federation, see Figures 1 and 2.

The forest cover of the Central Chernobyl region exceeds only slightly the forest cover of the Orel region. The average forest cover ratio for the CCR is only 8.8%. By regions it varies from 10.6% in Tambov region to 8.3% in Voronezh region. Within regions the range of forest cover reaches multiple values.

The main forest-forming species in the region are coniferous, hardwood and small-leaved trees. Their distribution is shown in Fig. 3.
Oak forests occupy almost half of the forest area of the Central Chernobyl region. They cover watersheds (watershed oakwoods), river valley banks (upland oakwoods), floodplains, gullies and ravines (byrachnye forests) in separate massifs. The oaks are good at water protection and soil protection. They are characterized by sturdy wood, so they were especially intensively felled. The largest oak massifs are the Tellerman Oak (42 thousand ha) and the Shipov Forest (34 thousand ha).
The main forest areas in Voronezh region include Usmanskiy and Khrenovskiy bors, Shipov forest and Tellermanovskaya grove. Low appraisal value of forest resources is typical for the Central Chernobyl Region, therefore timber reserves are low - 268.5 million meters³. The largest reserves are characterized by the largest Voronezh region 71.5 million m³ (at the beginning of 2019), Belgorod region - 49.9 million m³, Kursk region - 42.3 million m³, Lipetsk region - 35.6 million m³, Tambov region - 69.2 million m³. All of them belong to forest group 1, which is not exploited. Therefore the volume of logging is small: 981,4 mln.m³ in 1990 and 779,9 mln.m³ in 2019. The Tambov region accounts for 62.9% of logging in the district (491 thousand m³ in 2019), the Lipetsk region - 17.7% (138 thousand m³). In other oblasts, thinning is insufficient, which causes forest degradation and loss of valuable timber. Forest plantations growing in the steppe zone are adversely affected by drought climate and are often in conditions close to extreme. Particularly severe consequences for them had the drought of 2010, which caused not only here, but throughout the Central Black Earth Region, the death of forests on large areas, mainly from fires. On the whole in the Central Black Earth Region the area of dead plantations amounted to 33384 ha or 2.4% of the area covered by forests. The forest area traversed by fires this year was 42739 ha, or 3.1% of the total forest covered area. This is many times higher than in previous and subsequent years.

Figure 4. Forest area traversed by fires (ha) [Built by 4]

Nevertheless, the death of forests - this valuable natural treasure - is also tolerated in years with more favorable rainfall. It is associated with insufficient maintenance of forest plantations, with damage by insects and wild animals, as well as with environmental pollution (acid rain, radioactive pollution).

The situation with forest care was further complicated by the fact that in the 1990s, many of the collective farm forests, which had an important soil-protecting function, perished. In the 1990s, many collective farm forests, which had an important soil-protecting function, perished. The restoration and protection of forests located on agricultural land should become the most important task of the new economic entities - collective forms of agricultural production organization.

The current state of the forests of the Central Chernobyl Region is largely determined by past economic activity, when they were subjected to intensive logging. At present, primary felling is practically eliminated in the forests. Small areas of exploitable forests of the second category, in which limited logging is carried out, are gradually transferred to the first category, i.e. to the protective category. These include state protective forest strips; forests of scientific, or historical significance; natural monuments; especially valuable forest areas; anti-erosion and water protection forests; prohibited forest strips protecting spawning grounds of valuable commercial fish; forest-park parts of forests of green zones of settlements and economic objects.

One of the main factors of degradation of natural environment and bad ecological situation is overuse of natural resources. The share of agricultural lands in CCR is 79,4% (13,33 million ha out of 16,79 million ha of land area of the district). The share of arable land in the total land area of the district is 61.5% and in the agricultural land area it reaches 77.5%. In all constituent entities of the district the share of arable lands is too high - by 15-20% higher than optimal for soil conservation. To achieve a sustainable condition on chernozems, the maximum ploughing should be 60-65% of agricultural land [10,11,12].

The state of forest resources in the CCR also does not allow achieving a sustainable state of nature, preservation of water and soil resources. It is the deforestation of forests that causes too short spring floods, pollution and shallowing of rivers. Forest lands reached according to official data in 2019 1.536 million ha or 8.7% of the total area of the district, but in reality, this figure according to foresters'
estimates is much smaller, and for a sustainable condition it is necessary, according to our estimates, to have 1.56 times more forested area for all types of forests (Figure 5). Currently, only about 12% of the area of the CCR is covered by forests, wood and shrub vegetation, and perennial plantations [13].

Figure 5. Forest cover of the CCR by species, thousand ha [Built by 3,14-16]

The numbers under the column groups correspond to the following types of forest cover:
1 - arable; 2 - protective; 3 - agricultural; 4 - water protection;
5 - Forestry; 6 - Landscape; 7 - Resource and raw material; 8 - Ecological

The indicator of forest cover of all the above types of land use for the conservation of soil and water bodies, improvement of human settlements should be at least 15-17% of the territory. To significantly reduce the imbalance between carbon dioxide consumption and oxygen production, forest cover in the CCR should be three times the current size - 25%. Approximately the same value (23-24 %) should be achieved, according to our calculations, by the forest cover of the Chernozem territory, taking into account the achievement of sustainable condition of all types of terrain in the district [2, 11]. In this regard, there is a crisis situation in the subjects of the district, and in many MPs - a catastrophic environmental situation (table 1, fig. 7).

Table 1. Distribution of municipalities of the CCR by the share of forest area, in % [10]

| Areas       | Environmental situation |
|-------------|-------------------------|
|             | Disaster-, Crisis, Critical, Conflicted, Satisfactory, |
|             | %, %       | 6-12 | 12-20 | 20-25 | 25 or more |
|             | less than 6 |       |       |       |           |
| Belgorod    | 4           | 10    | 3     | 2      | 2          |
| Voronezh    | 4           | 16    | 9     | 3      | 1          |
| Kursk       | 10          | 14    | 4     | -      | -          |
| Lipetsk     | 12          | 2     | 4     | -      | -          |
| Tambov      | 12          | 3     | 6     | 1      | 1          |
| CDC as a whole | 42    | 45    | 26    | 6      | 4          |
Figure 6. Forest cover of the municipalities of the Central Chernobyl Region [Built by 3,5,11,14-16]
1 - over 25% (satisfactory situation); 2 - 20 to 25% (conflict situation); 3 - 12 to 20% (critical situation); 4 - 6 to 12% (crisis situation); 5 - less than 6% (catastrophic situation)

Only Shebekinsky urban okrug (33.17 %), Morshansky district (29.4 %), Voronezhsky district (31 %) and Stary Oskolsky district (25.6 %) have a satisfactory situation and six districts have a conflict situation. In areas with high forest cover in many rural settlements the share of forest land does not exceed 6%, in general in the Central Chernobyl region about 4/5 of all the districts are characterized by such indicators (in municipal districts the forest cover is higher due to some large forest areas). In Ramonsky District the forest cover in the eastern part exceeds 50%; in the western part of the district it is much lower. The area is characterized by a very low level of forest regeneration, 3.6 thousand ha in 2019, which is 6.4 times less than the level of the Kostroma Oblast alone (23 thousand ha). After the fires of 2010, the area of reforestation increased, although not sufficiently, see fig. 7.

Figure 7. Reforestation area in the CCR, thousand ha [Built by 4]

Figure 8. Reforestation for 2005-2019 (thousand ha) [Built by 4]

It should be noted that in the CFD, in contrast to the Central Federal District and Orel Oblast, the restoration of forest-covered areas is intensifying. In 2005-2019, 64.4 thousand ha of new forests were planted in the Chernozem region, which was not much higher than the area of burned stands. By comparison forest regeneration in the CFD from 2005 to 2019 amounted to 1007.4 thousand ha, in the Russian Federation it was 13088.2 thousand ha. Without reforestation the ecological situation cannot be improved. In terms of regions, the total reforestation for 2005-2019 is characterized by the following values, see fig. 8.
The leading position belongs to Voronezh Oblast, where in the early 2000s reforestation was carried out on relatively large areas, unlike in other oblasts of the region. Lipetsk and Tambov oblasts also paid significant attention to this problem, although on a smaller scale. The Belgorod and Kursk oblasts noticeably lag behind the other subjects of the region in carrying out reforestation work, which narrows the fulfillment by the forest of its diverse functions.

In general, the area of conversion of young plantations to the category of valuable (highly productive) forest plantations decreased in the district. The scale of forest planting does not allow to improve the ecological situation in the CCR.

4. Conclusions

In general, the area of forest resources in the Central Black Earth Region is characterized by sharp insufficiency, which causes an acute crisis situation in the natural environment of the region and destructive trends in the state of ecosystems. At the same time, there is a deterioration in the species composition of forest species, a decrease in the quality of thinning in large forests: often the forest in them is simply impassable due to fallen trees. Low forest cover in many areas badly affects water resources and soils.

In order to preserve fertility, it is necessary to use ecological-landscape (adaptive) or landscape-ecological farming system, which is based on natural protective contour-meliorative organization of landscapes. To combat erosion and preserve soil fertility, scientists have developed various methods. One of them is expansion of area of protective forest plantations, bringing it to 660 thousand hectares, including shelterbelt forests to 330 thousand hectares. Currently, their area does not exceed 150 thousand hectares. According to their opinion forest cover in Central Black Earth region should be not less than 15-20%, and 60-65% of chernozems should be covered with forests. The key factor for the entire sustainable condition of the Central Black Earth region is to increase the area's forest cover by at least two times. It is the forest plantations that form the ecological framework of sustainable nature management.

There is a need to apply an economic mechanism to combat carbon dioxide emissions, in which businesses and vehicle owners must provide the necessary amount of forest planting to recycle the carbon dioxide they produce. Nearly 1.5 million hectares of agricultural land are currently unused, especially on slopes. In order to restore soil and water resources, it is necessary to expand field-protective forest plantations at the expense of these low-productive agricultural lands.

On the whole, the Central Black Earth region is characterized by the pre-departure of complete ecological catastrophe, which is confirmed by the decrease in the number of species and diversity of fauna and flora. Exceptionally complicated ecological situation in the Central Black Earth Region on the basis of long-term degradation of nature requires appropriate system of restoration measures of the natural environment of the region and huge financial investments, which determines radical change of the strategy of nature management. It is necessary to invest tens of billions of rubles annually in the restoration and preservation of the natural environment in the district. To improve the ecological situation in the CFR we need to change our attitude towards nature. It is impossible to achieve a stable state of nature and improve the ecological situation everywhere on account of budget allocations. The country is implementing the national project "Ecology" (according to the May 2018 decree of V. Putin). According to it, the scale of budget financing of the Central Black Earth region in 2019-2024 should be about 20 billion rubles (mainly from the federal budget). The regions of the Central Black Earth Region have actively started to participate in solving a number of target tasks of this national project, one of which is the program "Conservation of forests". But as current experience shows, the amount of funding under this project allows partially solving only local problems in a number of key localities. A completely different scale of activities is needed. It is important to create a new sector of economy - nature conservation and restoration with appropriate infrastructure and funding. There needs to be a transition to the mass rehabilitation of nature, including the general ecological movement, similar to the one that was created in Soviet times. In the USSR, largely due to ecological priorities, it was possible to largely solve ecological problems in the southern part of Russia and to create the necessary network of
forest plantations. In this case it will be possible to achieve a radical improvement of water, forest and soil resources already in 10-15 years. Otherwise, the ecological catastrophe in the Central Black Earth region is inevitable.

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