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Article

The Norm of Annual Forest Burning in Russia

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Abstract: Wildfires are a serious problem in many countries. In 2022, the President of Russia set the task for the leadership of the regions to reduce the average annual area of forest fires by two times by 2030. To implement it, the amount of funding has been doubled. For each region, a standard of annual forest burnability was established, not exceeding which meant satisfactory work to protect forests from fires. At the same time, when calculating the standard, a simplified approach was used, when the value decreased from the current level inversely proportional to the increase in funding. This paper presents an alternative approach to the calculation of the standard, based on the rate of restoration of the initial (to fire) reforestation, taking into account the correction coefficients.

Keywords: forest fires, burnability standard, performance indicators

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1. Introduction

Wildfires are a serious problem in many countries. The damage from such fires in Russia over the past 5 years, according to official data alone, amounted to 65.5 billion rubles. Climate changes in recent years have only worsened the situation [1; 2]. Substantial funds are invested in protecting forests from fires, including extinguishing measures. In this regard, the issue of evaluating the effectiveness of such measures is acute. There are different approaches to choosing such indicators. There are approaches related to the assessment of measures taken directly during extinguishing [3–5]. There are approaches related to the assessment of the final indicators based on the results of the fire season [6]. According to most experts, some of the fires do not cause serious damage to the natural area and even play a positive ecological role, reducing the reserves of plant combustible materials. At the same time, the refusal to extinguish some fires can significantly reduce costs and reduce risks for firefighters [7].

The specifics of the Russian Federation are connected with vast territories of forests, as well as the federal state structure. Protection of forests from fire is entrusted to the regions, and supervision is carried out by the federal center. In these conditions, it is difficult to control each fire individually. One of the indicators of the effectiveness of the organization of forest protection from fires in certain regions is the prevention of the area covered by fire, a certain threshold value (annual standard of burnability). Attempts to scientifically substantiate the meaning of such a standard have been made before[8], but have not been officially approved.

As part of the FLEG II program (www.enpi-fleg.org), "Law enforcement and management in the forest sector of the countries of the Eastern region of the European Neighbourhood and Partnership Instrument-2", which was designed to provide support in strengthening the management systems in the forest sector of the participating countries.

In this approach, as an annual rate of burnability, it was proposed to use the average annual area of a forest formation, which can be measured within a forest management unit, taking into account the existing rates of the forest development process or the period of years required to restore the original (before fire) forest planting).

The main problem of the proposed approach was that the methodology was based on a detailed description of each forest area. Considering that in Russia, due to the large areas of forests, up-to-date information about forests is available only on the territory of active forest use, it was not possible to calculate the total value for the region as a whole.

Taking into account the problems with forest fires in the Russian Federation, the President of Russia set an ambitious task to reduce the area of fires by half by 2030. To implement this task, the volume of annual funding has increased significantly (by 2 times). Within the framework of this instruction, the Government of the Russian Federation approved the standard of permissible areas of forest fires for each region, if exceeded, the organization of forest protection from fires will be considered unsatisfactory (Figure 1). As a basis, a simplified approach was chosen to reduce the area inversely proportional to the increase in financing.

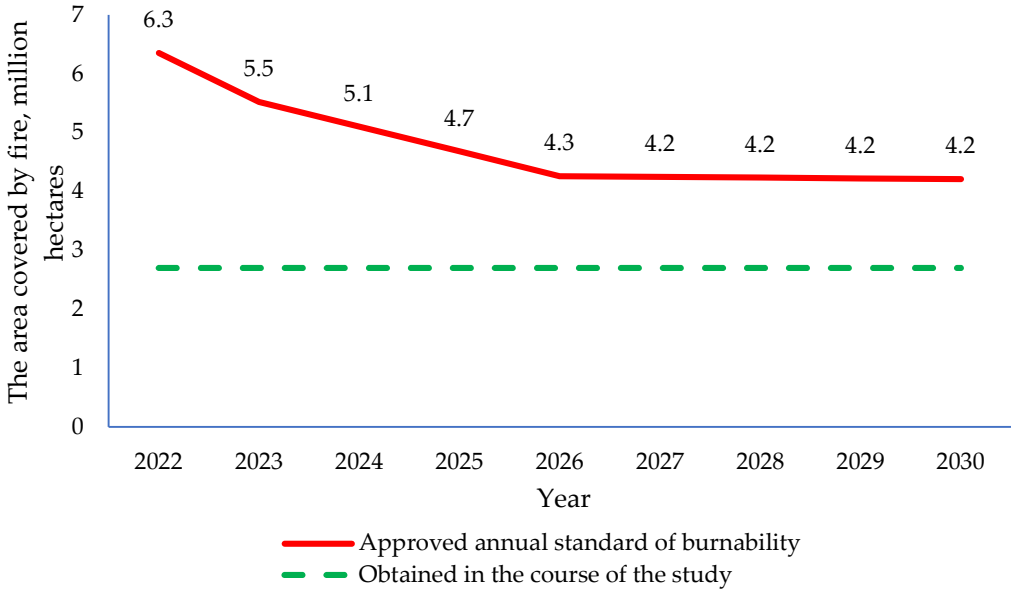

Figure 1. Legally established requirements for reducing the area of forest fires (in total for all regions).

There is no information about the scientific justification of the approved values in open sources.

Such an administrative decision has increased the interest of researchers in trying to calculate for each region the maximum area covered by fire during forest fires, which, according to environmental, social and economic factors, will be acceptable.

Within the framework of the presented study, we have taken as a basis a previously known technique [8], and adapted to the existing structure of information reporting in Russia. The software developed by us made it possible to calculate the annual standard of forest burnability in the context of regions and the country as a whole.

2. Materials and methods

The methodology taken as a basis [8] It was aimed at the transition of the fire-fighting strategy to the systematic management of forest fires or the burning of the territory. The purpose of this methodology was to manage the risk of possible damage from forest fires to forest areas, depending on their socio-economic and environmental value.

This approach is based on the zoning of forest management units. This requires taking into account a large number of factors: the availability of land, the level of their exploitation, whether these plots are leased and what their economic and environmental significance is. As sources of initial data, it was supposed to use, among other things, tax descriptions of specific sites (forest management materials). As mentioned above, these data are not available for most of the territories.

In the original methodology, forest fire zoning of the territory is carried out in 4 zones:

- Zone (A) - geographically and economically inaccessible forest lands, the development of which is not expected or is expected beyond the period of restoration of the harem.
- Zone (B) - economically accessible forest lands that are not under forest lease.
- Zone (C) - forest lands under forest lease and intensive exploitation.
- Zone (D) - forests and/or objects of increased or special socio-economic and ecological significance

  After analyzing the structure of the approved reporting, we proposed to focus on the indicators of the State Forest Register [9], which required reducing the number of zones to three.

  In our proposed version, it is proposed to allocate the following zones:
- Zone A - reserve forests (with the exception of specially protected natural areas (protected areas), forests of the water protection zone and forests that perform the function of protecting natural and other objects), young growth in operational forests.
- Zone B - has operational forests (with the exception of young trees).
- Zone C - protective forests, specially protected natural territories, forests located in the water protection zone, as well as forests that perform the function of protecting natural and other objects.

In the original methodology, it was supposed to take only pyrogenic forest formations as a basis. Due to the wide variety of forest growing conditions and various burn conditions, a list of pyrogenic forest formations has not been formed in Russia unanimously recognized by the forest community. In addition, there is no such information in the official reports. At the same time, most forest-forming species are exposed to forest fires. Thus, the proposed methodology was based on the available information on the main forest-forming species.

To calculate the annual rate of burnability, information is needed on the rate of forest formation or the period of years required to restore the original (pre-fire) forest planting). During this time, the age of the felling set for each region is taken into account [8].

The proposed algorithm for calculating the standard of annual burnability:

1. Based on the data of the State Forest Register, we form a list of felling ages for the forest-forming tree species of each region (birch, aspen, spruce, cedar, oak, low-stemmed oak, larch, beech, pine).
2. For cases when data on the age of felling for a particular breed in a particular region were not available, we use the permissible age of felling for this breed based on the requirements of legislation [10]. In a number of regions, the age of felling for "bush birch" has not been established. In this case, we use the value "20 years" (the average for other regions).
3. We calculate the annual standard of burnability according to the formula (1).

$$AFB = \sum_{i=1}^{n} \frac{1}{T} \times \begin{cases} (G3_p \times 0.1) & for\ PF = p \\ ((G4_o + G5_o) \times 0{,}8 + (G3_o - G4_o - G5_o) \times 0.4) & for\ PF = o, \\ (G3_b \times 0{,}8) & for\ PF = b \end{cases} \quad (1)$$

AFB – the rate of annual forest burnability;

PF – purpose of forests;
p – protective forest;
o – operational forests;
b – reserve forests;
G3 is the total land area. occupied by forest plantations;
G4 – the area of land occupied by young people of the 1st class of age;
G5 is the area of land occupied by young people of the 2nd age class.

3. Results

As a result of the calculations carried out, the area of the annual burning rate of 2,747,063 hectares was obtained for the entire area of forest lands of the Russian Federation. Among all regions of Russia, the Republic of Sakha (Yakutia) has the largest area of the permissible norm of burnability – 876,261 hectares, the Krasnoyarsk Territory – 389,121 hectares and the Irkutsk Region -240,927 hectares.

Since the areas of the regions differ significantly, the relative values of the standard (per 100 000 hectares of forest area (Figure 2) are calculated for comparison.

Figure 2. Relative values of the annual standard of forest burnability, hectares per 100 000 hectares.

Similar results are quite obvious for these regions, since the above-listed regions are the largest in area and have a high forest cover: 51.3% in the Republic of Sakha (Yakutia), 72.1% in the Krasnoyarsk Territory and 82.6% in the Irkutsk region. Based on the results obtained, it can be concluded that, when comparing the figures of burnability for any period of time, it is possible to determine in which regions of Russia it is necessary to increase the volume of fire-fighting measures, as well as the standard of the number and equipment of forest fire formations.

It should be borne in mind that the minimum level of burnability allows you to make an approximate estimate of the permissible impact on forests. At the same time, exceeding this threshold does not mean the direct fault of forest fire formations. Increased areas of forest fires may be associated with abnormal weather conditions. For an adequate assessment of the effectiveness of the organization of forest protection from fires, it is recommended to use indicators that take into account, among other things, the environmental factor [6].

4. Conclusions

The proposed methodology can become one of the tools for evaluating management decisions at the planning stage of forest protection from fires. In particular, the calculated values will allow balancing the distribution of fire fighting forces and means, as well as the amount of allocated funding.

Cost optimization will increase the level of forest protection from fires in the most critical areas for nature and the economy.

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