Actual issues of preservation of unique landscapes

Svetlana Volkova, and *Elena* Sivak*

Kursk State Agricultural Academy, Karl Marx Street, 70, Kursk, 305021, Russia

Abstract. The study outlines the essence and social significance of nature reserves, identifies the features and conditions for improving the efficiency of their reproduction, specifies and supplements criteria and indicators for assessing the level of their use and reproduction efficiency. The modern functioning of the reserve, the dynamics of its development are considered, a preliminary assessment of the material and financial security and the reproduction adequacy of the Streletsky section of the reserve is given. A logical scheme for determining the optimal size and configuration of the Streletsky section of the reserve has been developed, recommended regimes of using its biota have been differentiated, promising directions and sources of optimizing the reproduction of meadow-steppe herbage of the reserve have been identified. It is human, his scientific knowledge, moral and spiritual world, consciousness, as the original source of diligence and care, has always been the main condition for the well-being of the nature of steppe natural complexes and their harmony with human. A person should feel like its kind master, bringing his good work and art into it.

1 Introduction

The harmfulness and therefore inadmissibility of plowing meadow steppes has long been proved not only by natural scientists, but also by agricultural production practices in Russia. Nevertheless, there were significant disagreements with forestry workers, who proposed to actively enrich the natural complexes of mosaic-interspersed areas of the steppes with tree and shrub species, sometimes far alien to the native flora. Forests and steppes of the Kursk region were equally subject to conservation both in the reserve and outside it. But the vulnerability of the meadow steppes in the absolute conservation regime (ACR),* their degradation up to catastrophic irreversible changes, could not be predicted by either the practice of conservation, not many natural scientists. Only V.V. Alyokhin did it.

Only by the beginning of the 3rd millennium, more than 50 years after the death of the professor, well-founded experimental geobotanical data on prairification and afforestation of meadow steppes in the ACR regime were accumulated. After that, V.V. Alyokhin's fears for their changes in this regime became quite understandable to many people. He clearly foresaw the future expansion of various trees and shrubs in such steppes. Exactly for this reason he insisted on thorough studies of “non-portable” variants of the steppes at the stations of the Central Chernozem Reserve. Thus, he brilliantly predicted their future degradation.

* Corresponding author: elena.sivak.77@mail.ru

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2 Materials and Methods

Materials of the Federal State Statistics Service of the Kursk region, annual reporting data of agricultural enterprises, regulatory and reference information were used as an information base. The research was carried out based on monographic, abstract-logical, economic-statistical, economic-mathematical, fundamental biological methods.

3 Results and Discussion

In the process of desk work with a deep empirical study of the meadow steppe of the Central Chernozem State Natural Biosphere Reserve (CCR), a logical error "a dicto secundum quid ad dictum simpliciter" was revealed, unconsciously, and more often consciously introduced into scientific research by various authors since 1935.

In relation to the CCR, the following conclusion is the nodal one:

1. Some regimes of CCR protection contribute to the conservation of meadow steppes. (The definition of some is determined by the presence of other types of vegetation on the reserve territory and their expansion. These are forests, shrubs, meadows, swamps).

2. An absolutely protected regime, excluding both direct and indirect human intervention in the steppe natural complex, the protection of the CRC - is the protection regime of the CCR.

3. Absolutely conservation (AC) regime of CCR protection contributes to the preservation of meadow steppes.

There is a logical error "a dicto secundum quid ad dictum simpliciter" in this conclusion. The middle term CCR protection regime is taken without limitation only in the second assumption, since in this judgment all regimes are meant, which also include AC. In the first assumption, the middle term is taken with a restriction, since it is the subject of a private-affirming judgment, and the subject of such a judgment does not reflect the entire class, but only some part of the class. In the conclusion, what was taken with a restriction in the first assumption (only some, but not all, CCR protection regimes guard the meadow steppes) is extended to each regime, and hence the error.[1]

Based on the above, it is logical to assert that the AC (Absolutely Conservation) protection regime of the CCR is purely experimental and, in a temporary aspect, does not contribute to the preservation of the steppe type vegetation, which is objectively confirmed by empirical data from the Chronicles of the CCR nature. The application of the definition "Absolutely" to it is not applicable and should be replaced with "Academic", since it has a control and monitoring function and is equated in importance to pure permanent fallow, monocrops, experiments with fertilizers and irrigation, early spring, and late autumn fires. [3]

The aftergrowth pasture regime, which was restored in the CCR in the 90s of the last century, controlled by the scientific department of the reserve, requires special consideration among scientists of Kursk and Russia and parallel university research, since a sufficient period has passed since the beginning of its application.

It is known from agricultural practice that grass stands mown in summer, "overgrown" during the warm early autumn period, inevitably lose their generative shoots without forming mature seeds [4]. The first frosts lead to zero late-summer generative phase of steppe herbage development. Therefore, grazing is most expedient in part of August and September, and it is necessary to stop the alienation of steppe grass stands about a month before the onset of stable frosts, returning the planned livestock to the main pasture sector. Formal grazing on a well-grown aftergrowth is clearly detrimental to the structure of the meadow-steppe herbage of the following summer, since recently the expansion of trivial forest and meadow plants has been great. [5]

Forest species constantly destroyed by summer mowing do not require their alienation in the autumn period, but meadow, forest-meadow species: Asparagus officinalis L., Bunias orientalis L, Sentaurea jacea L., Heraculum sibiricum L., Leucanthemum vulgare Lam., Rumex confertus Willd., Trifolium pratense L., and especially aggressive as of today Arrhenatherum elatius (L.) J. et C.Presl, and in general all broad-leaved cereals - can be successfully brought to the desired vegetative phase. [6]

Long-term geobotanical observations at a permanent hay rotation station with aftermath pasture over the past 17 years (see The Chronicle of Nature of the CCR) states highly stable parameters of the growth of the aboveground phytomass of meadow-steppe herbage. The range of fluctuations of these values varies by year depending on weather conditions from 47 to 72 c/ha. [7] Only at the very beginning of grazing application. There was a moderate, but not catastrophic, amount of summer growth – 39 c/ha. The latter can be explained not so much by unfavorable weather conditions as by the early taking of mowed samples.

To carry out high-quality, evenly diffuse grazing along the aftergrowth, the inadmissibility of hypertrophied tropical erosion, the high professionalism of the shepherd*s* is important (of paramount importance), but also a skillful strategy of the areas allocated for grazing, without preserving them permanent once for all. Their rotation with neighboring blocks (originally, 13 and 18 blocks) is also topical. [8]

The culmination of the grazing strategy is the introduction of a rotational pause not after the 9-year cycle of alienation, but for every 5th year and to coincide it not with the 10th year of non-mowing, but with the 5th mowed year, according to the 10-year general hay rotation. [9] With this variant of the regime, as agreed with Professor of the KAA V.S. Bobylev, the processes of phytocell migration, in general, the dissemination of plant components of meadow-steppe communities, will be closer to the natural and evolutionary gradients of biota that existed in the past.

The final point of all the above will be the establishment of a new control station based on a permanent one (PSONI 5.2.1), which will most fully approach in its reference qualities to the classical steppe of the period of its opening, that is, the beginning of the last Century. [10]

According to all the above, clearly, a significant correction of the main document determining the functioning of the CCSNBR "Regulations on the Federal State Institution "Central Chernozem State Natural Biosphere Reserve named after Professor V.V. Alyokhin" will be required. The final data of geobotanical studies and the present research will serve as a basis for this. [11]

The estimated part of reproduction efficiency (%) per 1 sq.m. (Table 1) (Fig. 1 – Fig. 5). $\overline{A} = 38;\ \overline{P} = 64;\ \overline{S} = 69;\ \overline{E} = 68.$

Table 1. Comparison of reproduction efficiency (%) of meadow-steppe grass stands depending on the regimes E, S, P, A on meter squares.

No.	E	S	P	A	$A - \overline{A}$	$(A - \overline{A})^2$	$P - \overline{P}$	$(P - \overline{P})^2$	$S - \overline{S}$	$(S - \overline{S})^2$	$E - \overline{E}$	$(E - \overline{E})^2$	$G - \overline{G}$	$(G - G)^2$
1	68	68	70	42	4	16	6	36	-1	1	0	0	-10	100
2	64	62	69	43	5	25	5	25	-7	49	-4	16	-9	81
3	67	70	69	37	-1	1	5	25	1	1	-1	1	-8	64
4	69	64	67	47	9	81	3	9	-5	25	1	1	-7	49
5	69	71	57	49	11	121	-7	49	2	4	1	1	-6	36
6	67	62	66	41	3	9	2	4	-7	49	-1	1	-5	25
7	67	66	64	37	-1	1	0	0	-3	9	-1	1	-4	16

8	69	68	69	44	6	36	5	25	1	1	1	1	-3	9
9	71	69	66	42	4	16	2	4	0	0	-3	9	-2	4
10	64	75	51	38	0	0	-13	169	6	36	-4	16	-1	1
11	66	67	60	37	-1	1	-4	16	-2	4	-2	4	0	0
12	66	72	63	38	0	0	-1	1	-3	9	-2	4	1	1
13	67	70	64	39	1	1	0	0	1	1	-1	1	2	4
14	69	69	63	37	-1	1	-1	1	0	0	1	1	3	9
15	74	74	60	30	-8	64	-4	16	5	25	6	36	4	16
16	69	73	68	34	-4	16	4	16	4	16	1	1	5	25
17	65	70	65	36	-2	4	1	1	1	1	-3	9	6	36
18	71	66	58	32	-6	36	-6	36	-3	9	3	9	7	49
19	69	73	61	28	-10	100	-3	9	4	16	1	1	8	64
20	64	69	63	28	-10	100	-1	1	0	0	4	16	9	81
$\overline{X}$	68	69	64	38		629		443		256		129		670

Corrected mean square deviations rounded to integer values

$S^*_{\overline{A}} = 6;\ S^*_{\overline{P}} = 5;\ S^*_{\overline{S}} = 4;\ S^*_{\overline{E}} = 3.$

$Eff_{A} = 38 \pm 6;\ Eff_{\overline{P}} = 64 \pm 5;\ Eff_{\overline{S}} = 69 \pm 4; Eff_{\overline{E}} = 68 \pm 3$

Comparison of the average reproduction efficiency shows that the discrepancies are significant with the reliability of the output of 99% (t_t (0.99; 37) = 2.71) for pasture and academic regimes, namely $Eff_{\overline{P}} > Eff_{\overline{A}}$,(t_p=14.5) $Eff_{\overline{S}} > Eff_{\overline{P}}$, ($t_p$=3.4) $Eff_{\overline{E}} > Eff_{P}$,(t_p=2.99).

It is not significant, namely, annual mowing (E) and hay rotation (S) (t_p=0.87) $t_P < t_t$ – for this case.

$$Eff_{\overline{S}} > Eff_{\overline{E}} > Eff_{\overline{P}} > Eff_{\overline{A}}$$

It turns out that the lower limit of the recovery regime, the effectiveness of which is with a clear downward trend, as evidenced by the correlation coefficient r_{GA} =-0.80 and the direct regression Eff_A =-0.78·G+46.58 over the years. According to our calculations, based on the results of processing twenty years of research, it turns out that after 60 years in the academic regime, the number of VSR types will be equal to 0, i.e. by 2068 there will be no trace of meadow-steppe grass stands.

Eff_A=0; 0.78·G=46.58; G=59.7179≈60 years.

The upper limit of the recovery regime is the hay rotation with a wave-like or pulsating trend of recovery efficiency. The other regimes, namely pasture and annual mowing, are between them. Also, with a wave-like trend of recovery efficiency. [12].

As for the relationship between the P, S, E regimes by year, these values clearly do not correlate as an academic regime, as indicated by the correlation values in which part of the average tightness decreases to weak.

r_{GR}=-0.38, r_{GS}=0.37, r_{GE}=0.17

Having checked them for correlability in fact, we get from the criteria that $N_P < N_T$ with the reliability of the output of 99% of the year is not the prevailing factor of the P, S, E recovery regimes. The differences are only in the signs for the pasture wave-like regime with a tendency to decrease the amplitude of the recovery efficiency, and in annual haymaking and hay rotation with a tendency to preserve, i.e. striving for a constant, considering errors (Fig. 6 - Fig. 8).

Integral estimates for the efficiency (%) of reproduction of meadow-steppe grass stands depending on the regimes E, S, P, A.

$$t_P \cdot \frac{S_A^*}{\sqrt{n-1}} = 2{,}861 \cdot \frac{6}{\sqrt{19}} = 3{,}938 \approx 4$$

$$\overline{\mathrm{A}} - \mathrm{t_P} \cdot \frac{\mathrm{S_A^*}}{\sqrt{\mathrm{n}-1}} < A < \overline{\mathrm{A}} + \mathrm{t_P} \cdot \frac{\mathrm{S_A^*}}{\sqrt{\mathrm{n}-1}}$$

34<A<42 considering the error 28<A<48 (Fig. 1)

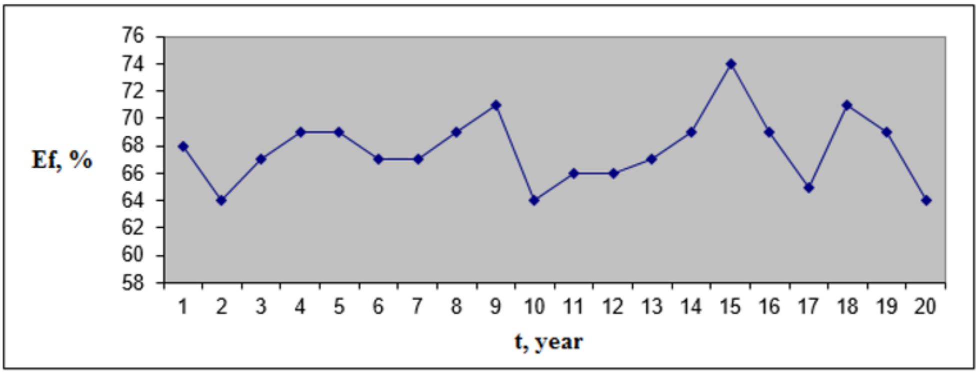

Fig. 1. Efficiency (%) of reproduction of meadow-steppe grass stands of the Central Chernozem State Natural Biosphere Reserve for annual mowing (regime E) on meter squares.

$$t_P \cdot \frac{S_A^*}{\sqrt{n-1}} = 2{,}861 \cdot \frac{5}{\sqrt{19}} = 3{,}938 \approx 3$$

61<P<67 considering the error 56<P<72 (Fig. 2)

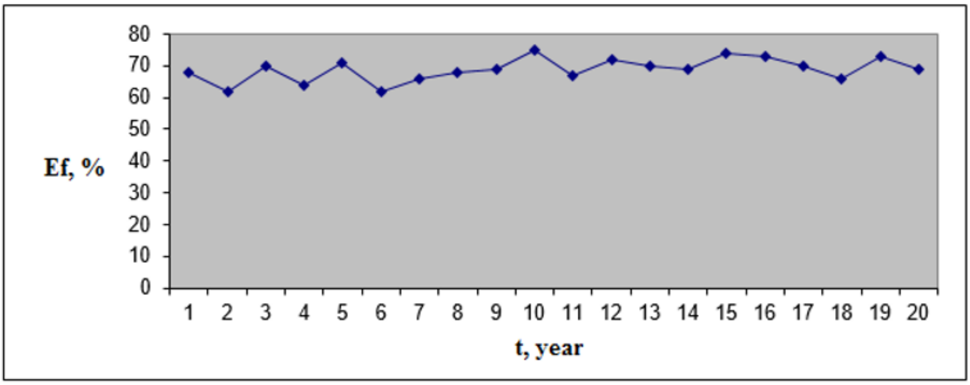

Fig. 2. Efficiency (%) of reproduction of meadow-steppe grass stands of the Central Chernozem State Natural Biosphere Reserve for hay rotation (regime S) on meter squares.

$$t_P \cdot \frac{S_A^*}{\sqrt{n-1}} = 2{,}861 \cdot \frac{4}{\sqrt{19}} = 2{,}625 \approx 3$$

66<S<72 considering error $\overline{\text{S}}$62<S<76 (Fig. 3)

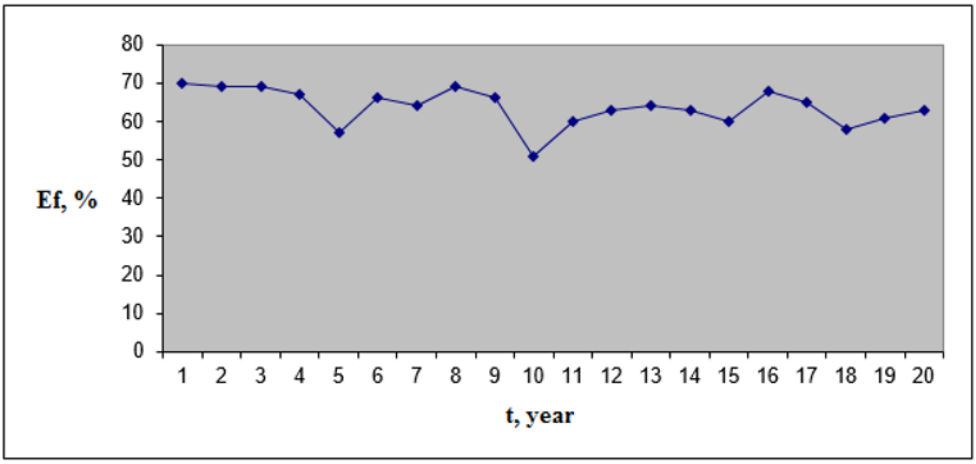

Fig. 3. Efficiency (%) of reproduction of meadow-steppe grass stands of the Central Chernozem State Natural Biosphere Reserve for pasture (regime P) on meter squares.

$$t_P \cdot \frac{S_A^*}{\sqrt{n-1}} = 2{,}861 \cdot \frac{3}{\sqrt{19}} = 1{,}969 \approx 2$$

66<E<70 considering error 63<E<73 (Fig. 4)

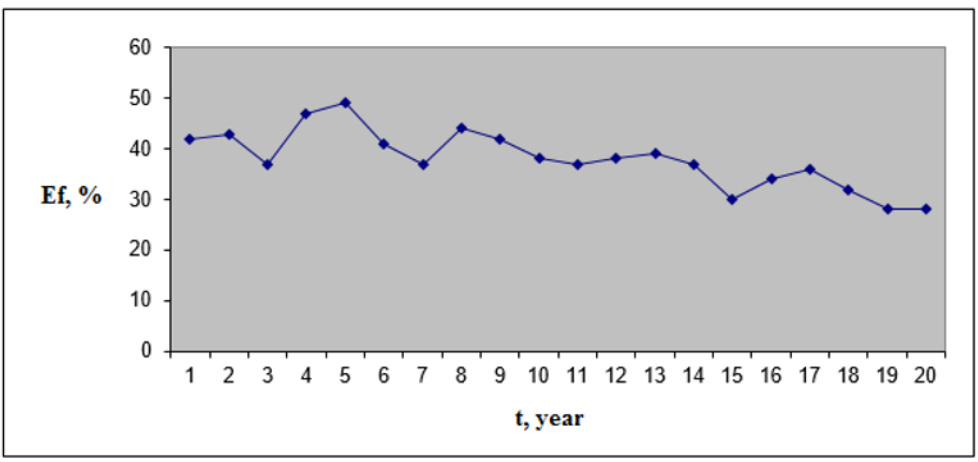

Fig. 4. Efficiency (%) of reproduction of meadow-steppe grass stands of the Central Chernozem State Natural Biosphere Reserve for academic (regime A) on meter squares.

Thus, the number of VSR types by regime can be represented as a function on integral segments (Fig. 5):

$$\frac{Eff}{VSR} = \begin{cases} VSR_{\mathrm{A}}, 28 \leq \mathrm{A} < 48 \\ VSR_{\mathrm{P}}, 56 < \mathrm{P} < 72 \\ VSR_{\mathrm{E}}, 63 < \mathrm{E} < 73 \\ \mathrm{VSR_S}, 62 \leq \mathrm{S} < 76 \end{cases}$$

Combining the regimes E and S we get, i.e. E ∈ S

$$\frac{Eff}{VSR} = \begin{cases} A, 28 \leq \frac{Eff}{VSR} < 48 \\ P, 56 < \frac{Eff}{VSR} < 72 \\ \mathrm{E}, 62 \leq \frac{Eff}{VSR} < 76 \end{cases}$$

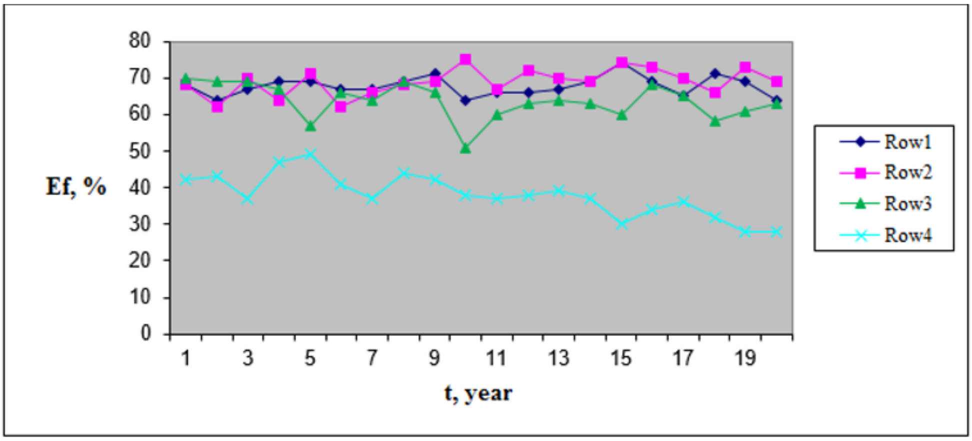

Fig. 5. Efficiency (%) of reproduction of meadow-steppe grass stands of the Central Chernozem State Natural Biosphere Reserve for different regimes: 1 - annual mowing (E); 2 - hay rotation (S); 3 - pasture (P); 4 - academic (A) on meter squares [13].

4 Conclusions

1. The meadow steppe as an example (paradigm) of the art of "tirelessly working Nature" in our reserve allowed it to be used in the long-term national economic plans of the USSR, and now it is also in demand in modern Russia. In connection with the increase in the energy availability of modern society and the profitability of farms, expanded reproduction of the reserved meadow steppe is possible, with the primary, mandatory, and as its initial phase optimization of the boundaries and configuration of the reserve areas. [14]

2. The livestock grazing regime requires careful use to preserve the meadow steppes, since overgrowing with its tree-shrub type of vegetation is inevitable, and we are witnessing such an expansion. The way out of this situation is: periodic transfer of pastures across the protected area and fragmentary control of its components with the asset of their removal.

3. Annual mowing and hay rotation are the most promising and optimal for preserving the entire wealth of meadow-steppe grass stand. With the processes of mesophytization of meadow-steppe communities dominating recently, preference should be given to annual multi-time (June-August) mowing. The latter can be the most important tool for stabilizing the classical perspective pictures of the steppe and reducing the catastrophic number of individual herbaceous components, which we also witness, such as summer rattle, tall oat grass, and some others, which will be discovered by subsequent observations.

4. The steppe of CCSNBR currently needs, due to the need for differentiated regimes, urgent measures to save it, with its rational use. The richness and uniqueness of nature will ensure both the optimum of natural conditions and a reasonable human approach to the conservation of the biosphere with a sharp look into the distant and near future. [15]

5. If we do not want the meadow-steppe biosphere reserve to turn into a forest or a desert, then we should consider the research of scientists on the restoration and reproduction efficiency of meadow-steppe grass stands based on 20 years of research experience and

scientific processing of the materials obtained under different modes of reproduction efficiency.

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