The state of natural grass at the reclamation facility of Ryazan Meschera

O A Zakharova1, D E Kucher2, R N Ushakov1 and A V Ruchkina1

1 FSBEI HE “Ryazan SATU Named after P.A. Kostychev” Kostychev Str., 1, Ryazan, 390044, Russia
2 Agrarian and Technological Institute of the Peoples’ Friendship University of Russia (RUDN University), 10/3, Miklukho-Maklay Str., Moscow, Russia

E-mail: ol-zahar.ru@yandex.ru

Abstract. The purpose of the geobotanical survey was to analyze the natural grass stand at the Tinki-II drained object within Ryazan Meschera. When monitoring the former forage lands, the methods of Bogolyubov and Kravchenko, Neshtaev and others were used. The meadow survey area had an area of 10,000 m² and was located near the main canal, a tree belt area, a settlement and an open collector. Earlier monitoring studies revealed the presence of degradation processes in peat soil that has been drained for 65 years, which manifested itself in the form of peat depletion, an increase in density, and the transformation of peat into a humified mass. The local flora dominated with the inclusion of such species as Elytrigia repens, Hypericum perforatum, etc. Plants with frequent occurrence and high Druda abundance (Elytrigia repens and Alopecurus pratensis) were identified. The association Elytrigetum urticaeum was highlighted. The entire variety of phytocenosis was grouped into dynamic series of community development: perennial, biennial, and annual grasses, considering their aboveground mass. The prospects for the development of meadow farming are unsatisfactory due to the low level of development of animal husbandry. At controlled facility Tinki-II, only 5% of the meadow area leased by the Novoselki agricultural holding is now sown

1. Introduction

When solving the problem of food security and import substitution, it is necessary to pay attention to fodder lands, including hayfields and pastures. Today, meadows in the country amount to a little more than 90 million hectares, of which 67 million hectares are pastures and 33 million hectares are hayfields [1-6]. But, unfortunately, they are in an unsatisfactory state from the reclamation point of view. So, Academician B.S. Maslov wrote in the late 1990s: 30% are eroded and deflated; 23% are hydromorphic and waterlogged; 38% are saline, alkaline and solonetzic complexes; 11% are stony and 40% are forested, bushy, getting hillock. More than 22% of Ryazan region territory is occupied by meadows, which is about 9,000 km², but at present their cultural and technical state is unsatisfactory [1; 3; 5; 7] for various reasons, the main one of which is the low level of development of animal husbandry and leaving areas of agricultural use.

2. Materials and methods

The purpose of the phytosociological monitoring was to analyze the natural grass stand at Tinki-II drainage facility operating within Ryazan Meschera. The survey was carried out over the past three
years at Tinki-II reclamation facility, organized in Ryazan Meschera in 1955 on an area of 285 hectares. The fodder lands at the reclamation facility were located on an area of up to 130 hectares, of which 55 hectares were pastures and 75 hectares were hayfields. During the monitoring, the methods of Bogolyubov and Kravchenko, Neshataev, Drude, Raunkier and Serebryakov, Shenikov were used [1; 2; 4; 8]. Statistically, the data of the survey of herbaceous vegetation of the meadow were processed for reliability in the universal integrated system of visualization of research results Statistica 10. During the years of research, the weather conditions were distinguished by heat and moisture supply. Selyaninov's hydrothermal coefficient ranged from 0.9 to 1.4.

3. Results
Dominant plants *Elytrigia repens* and *Alopecurus pratensis* having fairly high abundance were revealed. *Urtica dioica* had often high abundance. The following long-rhizome and loose-bunch mesophilic species also prevailed among cereals *Bromopsis inermis, Dactylis glomerata, Festuca pratensis, Phleum pratense, Poa pratensis*. The following legumes occur at a lower frequency: *Lathyrus pratensis, Medicago falcata, Trifolium pratense, Vicia cracca* as well as forbs of *Ranunculus acris, Alchemilla vulgaris, Geranium pratense, Plantago media, Galium mollugo, Campanula patula*, etc. Areas with *Deschampsia caespitosa, Festuca rubra, Nardus stricta, Carex nigra, Geum rivale, Potentilla erecta, Hypericum maculatum, Gentiana pneumonanthe, Melampyrum pratense* were found in areas with a close groundwater occurrence, depending on the supply of nutrients to the soil [5]. Meadow vegetation (figure 1) consisted of perennial hygro- and mesophytic herbaceous plant species that formed on the site of deforested forests and drained peatlands [6; 9; 10].

![Figure 1. The main channel in the meadow and the general view of the meadow.](image)

The main systematic (taxonomic) unit in the description of vegetation was the association. The aspect, that is, the physiognomy of the meadow during the monitoring, had a grayish-green dominant color with minor blotches of white-pink along the edges of the plot, due to forbs flowering. The total coverage was over 99 %. The grass stand on the site was very dense and evaporation from the soil surface was minimized. Dominant plants *Elytrigia repens* and *Alopecurus pratensis* had frequent occurrence and high abundance (figure 2). As a result of the phytosociological monitoring carried out on the surveyed plot of the meadow, an association of dominant plants *Elytrigetum urticetosum* was identified (table 1).

Based on the above, the current state of the natural meadow is satisfactory. The economic use in the past is fodder, at present it is not used. Since 2018, a small plot of meadow with a size of up to 5 % of the area has been leased by agricultural holding Novoselki and the vetch-oat mixture was sown for haylage (figure 3) for fodder purposes. Of course, this will not solve the problem of peat soil degradation under conditions of prolonged drainage. First of all, to create ecological balance and prevent secondary waterlogging of the territory, it is necessary to restore the drainage system.
Figure 2. The botanical summary of the surveyed meadow area at the reclamation facility.

Table 1. Data from a phytosociological survey of a meadow section of Tinki-II reclamation facility.

| Russian               | Latin                   | Average height, cm | Occurrence | Abundance according to Druda | Association name   |
|-----------------------|-------------------------|--------------------|------------|-------------------------------|--------------------|
| Couch grass           | *Elytrigia repens*      | 114                | 98         | soc                           |                    |
| Foxtail grass         | *Alopecurus pratensis*  | 88                 | 47         | cop.1                         |                    |
| Bastard toadflax      | *Linaria vulgaris*      | 46                 | 49         | cop.1                         |                    |
| Stinging nettle       | *Urtica dioica*         | 89                 | 68         | cop.3                         |                    |
| Fowl bluegrass        | *Poa palustris*         | 60                 | 60         | cop.3                         |                    |
| Common oats           | *Avena sativa*          | 67                 | 34         | sol.-sp.                      |                    |
| Reed canary-grass     | *Phalaris arundinacea*  | 80                 | 67         | cop.3                         |                    |
| Common timothy        | *Phleum pratense*       | 78                 | 39         | sol.-sp.                      |                    |

Maintaining the biological diversity of herbs and their natural regeneration requires consideration of issues in which the diversity of plant organisms is manifested, in particular, taxonomic,
biomorphological, ontogenetic, ecological and others. The species composition of the flora of many regions of Russia has been studied quite fully, but it is of particular interest to study the meadow at long-term (from the end of 1955 to the present) reclamation systems, which have now fallen into decay and are degrading. Such a cenosis is the meadow of Tinki-II reclamation facility.

4. Discussion
The entire variety of phytocenosis was grouped into dynamic series of community development: perennial, biennial, and annual grasses, considering their aboveground mass. The study identified frequently recurring factors limiting the productivity of meadow grasses, expressed as axes on a graph that reflects the effect of water regime on vegetation (soil moisture and groundwater level), soil and air temperature, light, soil fertility, remoteness from the residential sector [2]. The studied representatives of herbaceous vegetation between the first two axes are fanned out between *Eriohorum polistachyum* and acuminate sedge, depending on the predominance of the species. Hence it follows that the second axis displays the curve of the phyto cenotic optimum of these two species. The above factors have a strong effect ($R = 0.86$) on the productivity of the meadow, as shown by the analysis of the method. Thus, the vegetation of the surveyed meadow area at Tinki-II reclamation site is distinguished by a fairly diverse species composition of meadow legumes and grasses, forbs with a pronounced dominance of *Elytrigia repens* and *Alopecurus pratensis*.

5. Conclusion
Despite degradation processes in peat soil under conditions of long-term reclamation, the vegetation cover of the surveyed area of the meadow is rich in different species, dominated by *Elytrigia repens* and *Alopecurus pratensis*. Association *Elytrigetum urticaeum* is highlighted. Statistical processing of the data established a significant relationship between the density of vegetation cover and species diversity with abiotic factors. Prospects for the development of meadow farming are favourable.

References
[1] Byshov N V, Uspenskiy I A, Yukhin I A and Limarenko N V 2020 Ecological and technological criteria for the efficient utilization of liquid manure. *IOP Conference Series: Earth and Environmental Science* 422 (1) 012069
[2] Bakulina G, Fedoskin V, Pikushina M, Kuikhar V and Kot E 2020 Factor analysis models in enterprise costs management. *International Journal of Circuits, Systems and Signal Processing* 14 232-240
[3] Churilova V V, Churilov G I, Churilov D G, Polischuk S D and Arapov I S 2020 Effect of metal nanoparticles on the accumulation and structure of rapeseed carbohydrates. *IOP Conference Series: Earth and Environmental Science* 422 (1) 012089
[4] Marusin A V, Danilov I K, Khlopkov S V, Marusin A V and Uspenskiy I A 2020 Development of a mathematical model of fuel equipment and the rationale for diagnosing diesel engines by moving the injector needle. *IOP Conference Series: Earth and Environmental Science* 422 (1) 012126
[5] Musayev F, Danilin S, Zakharova O and Rodikov S 2020 Agroecological role of biohumus on sod-podzolic soil during irrigation of the rump-timothy grass mixture. *E3S Web of Conferences* 210 04003
[6] Ryazantsev A I, Garenko G V, Uspensky I A, Antipov A O, Rembalovich G K and Kostenko M Yu 2019 Ecological-energy directions for improving multiple sprinkling machine. *ARPN Journal of Engineering and Applied Sciences* 14 (3) 677-685
[7] Teterin V, Terentyev V, Andreev K, Shemyakin A and Teterina O 2020 Study of the parameters and operating modes of the installation for aerosol treatment of seed grain. *E3S Web of Conferences: Ecological and Biological Well-Being of Flora and Fauna* 203 02011
[8] Uspenskiy I A, Rembalovich G K, Yukhin I A, Ryachikov D S and Stepashkina A S 2020 Development and testing of a conveyor for detecting various types of vehicles when
transporting agricultural products from the field. *IOP Conference Series: Materials Science and Engineering* **832** *(1)* 012059

[9] Vinogradov D V, Vysotskaya E A, Naumtseva K V and Lupova E I 2020 Features of using modern multicomponent liquid fertilizers in white mustard agrocoenosis. *IOP Conference Series: Earth and Environmental Science* **422** *(1)* 012014

[10] Vinogradov D V, Makarova M P and Kryuchkov M M 2020 The use of mineral fertilizers in sunflower crops in the conditions of Ryazan region. *International Conference on World Technological Trends in Agribusiness IOP Conf. Series: Earth and Environmental Science* **624** 012077