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CRITICS AND BIBLIOGRAPHY

Book Review: P.L. Gorchakovskii, *Antropogennaya transformatsiya i vosstanovlenie produktivnosti lugovykh fitotsenozov* (Anthropogenic Transformation and Restoration of Productivity of Meadow Phytocenoses), Yekaterinburg: Yekaterinburg, 1999, 156 p.

Secondary postforest meadows play an important role as the carriers of high genetic diversity and the source of forage for animal husbandry. The anthropogenic impact on these communities has been increasing mainly because of overgrazing. As a consequence, highly productive grass stands with a high species diversity are replaced by short-grass synanthropic communities or sown mixed grasses, both including only a few species. This sad observation can be regarded as a truism. However, the data on the ways in which meadow degradation occurs in different regions are obviously insufficient, as well as the experimental data on methods for restoring the productivity and species diversity of meadows.

In the book reviewed, the author comprehensively analyzes the process of anthropogenic transformation of meadows in the Middle Urals, thus making an important contribution to studies on reconstructing the general picture of meadow degradation under the effect of overgrazing. Moreover, the book contains interesting materials on the possibilities of restoring meadow communities.

In the "Introduction," the author emphasizes the existence of a direct relationship between species diversity and stability of communities: communities with a high species diversity are more stable than those consisting of a few species.

The first chapter, "Transformation of Upland Meadows under the Effects of Hay Cutting and Livestock Grazing," begins with the definition of "synanthropization of vegetation" as the main process accompanying the increase of anthropogenic pressure on natural ecosystems. Gorchakovskii cites his previous works: "In fact, synanthropization is the process of plant world adaptation to environmental conditions created or altered as a result of human activities. The forms of its manifestation are very diverse (Gorchakovskii, 1979, 1984); in particular, they include the invasion of synanthropic species into plant communities, the replacement of natural primary communities by secondary and synanthropic communities, the reduction of diversity and species richness, structural simplification, and a decrease in productivity and stability of plant communities" (Gorchakovskii, 1999, p. 7).

Thereafter, the author characterizes the method of research, which proves to be thought out fairly well, and formulates the criteria for distinguishing four levels of meadow synanthropization, from communities saturated with forest species to short-grass pastural cenoses. He studied eight communities representing all the four stages of anthropogenic transformation: (1) meadows recently formed in the areas formerly occupied by forests, (2) meadows used for hay cutting for longer periods of time, (3) meadows exposed to intensive grazing, and (4) heavily overgrazed communities with a very poor species composition that consist of only synanthropic species, mostly annual or annual–biennial.

Properly chosen objects with a uniform environmental background allowed the author to obtain conclusive quantitative data characterizing the process of community degradation under grazing load: species diversity decreases from 64–76 to 10, productivity decreases from 1788–2390 to 315 g/m^2 (air-dry matter), whereas the level of synanthropization increases from 3.6 to 100%. A characteristic feature of the degradation process is that the ratio of aboveground and underground phytomass remains virtually unchanged, as overgrazing equally affects "tops and bottoms" of meadow grasses.

The data on soil density are illustrative: under the increasing grazing load, this parameter gradually increases from 7–9 to 28–30 kg/cm^2. Consequently, the distribution of phytomass (especially aboveground) changes as well, as the grass stand "clings" to the soil surface.

The author presents original data on the effect of grazing on seed productivity of species resistant to it, such as *Plantago major, Taraxacum officinale, Leontodon autumnalis, Capsella bursa-pastoris,* and *Polygonum aviculare*. In all cases, this parameter proved to decrease by a factor of 2.9–9.5 upon the increase of grazing load. Hence, pastural stress-tolerant species also suffer from overgrazing in their own way, although depression of other species gives them competitive advantages.

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Concluding this chapter, the author characterizes six groups of meadow species with respect to grazing tolerance, indicating their adaptive features and biomorphs.

In the second chapter, "Degradation of Floodplain Meadows under the Effect of Grazing," similar data on the pastural digression of floodplain meadows near the Chusovaya and Ambarka rivers are presented. They concern a great variety of the communities differing in moistening, from genuine to swamped meadows. Compared to the processes described in Chapter 1, the dynamics of vegetation in the course of pastural digression of floodplain meadows is characterized by one more trend, namely, convergence of the communities.

Thus, the pastural load on floodplain meadows leads to the decrease of both alpha-diversity (species richness) and beta-diversity (diversity of communities). Apparently, the main conclusion drawn by Gorchakovskii—"the intensity of synanthropization increases from the lower to the higher level of the floodplain"—is not a generalization but reflects a concrete situation with wet meadows of the studied rivers, which are exposed to a lesser grazing load extent. Generally, wet meadows especially suffer from intensive grazing.

In the third chapter, "Restoration of Potential Productivity of Upland Meadows," the results of three experiments on productivity control are analyzed: the effect of different combinations of mineral fertilizers (N_{60}, P_{60}, K_{60}, $N_{60}P_{60}$, $N_{60}K_{60}$, $P_{60}K_{60}$, $N_{60}P_{60}K_{60}$), the effect of increasing doses of nitrogen fertilizers (N_{30}, N_{60}, N_{90}, N_{120}) against the steady background of phosphorus and potassium fertilizers ($P_{60}K_{60}$), and the effect of intensive (two- to three-time) hay cutting against the background of fertilizers applied at doses of $N_{180}P_{60}K_{90}$.

The results of this analysis confirm well-known regularities: yielding capacity sharply increases upon application of increasing doses of nitrogen fertilizers, but species diversity decreases approximately twofold. This occurs because the competitive ability of strong tall grasses (*Dactylis glomerata, Elytrigia repens, Festuca pratensis, Agrostis gigantea, Poa pratensis, Phleum pratense*) increases and displaces from the grass stand the majority of legumes and herbs (*Ajuga reptans, Campanula patula, Coronaria flos-cuculi, Dianthus deltoides, Hieracium pratense*, etc.).

Three-time hay cutting exhausts plants even against a favorable agronomic background, leading to the decrease of yielding capacity (by 25%) and species diversity (by more than 50%). Hence, to optimally solve the problem of obtaining high hay yields and to preserve biodiversity, it is advisable to avoid the application of nitrogen fertilizers at high doses, intensive grazing, and three-time hay cutting.

In the last chapter, "The Strategy of Preserving Floristic and Cenotic Diversity of Meadows under Rational Management," the author discusses the origin of the meadow flora and the adverse consequences of decrease in the area and productivity of natural meadows and gives compelling evidence that the replacement of natural meadows by sown grasses is inexpedient. He emphasizes the great value of forage obtained from natural meadows and the significance of genetic resources of the meadow flora, which have not yet been put to proper use. Another question discussed in this chapter concerns the necessity of sharply increasing the number of meadow flora reserves and the rational management of meadow communities, including moderate hay cutting and livestock grazing.

Special reference plots are necessary for monitoring the state of meadows. In essence, this process should consist in revealing differences between the "potential" vegetation in these plots and the vegetation in its actual state at experimental stations.

In general, this book makes a pleasant impression on the reader because of its lucid structure, good illustrations, and expressive language. It will be useful for specialists and, especially, students in phytocenology and grassland ecology. The only disadvantage is the lack of statistical data processing. However, the trends revealed are so obvious that such processing would only have confirmed them without providing any new information.

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