Refugium role of natural-territorial complexes of Samara Oblast (south-east of European Russia) in the conservation of petrophytic flora and vegetation

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Abstract. Soils in the Samara Oblast are dominated by chernozems, so significant areas are allocated for arable land. Because of this, many natural complexes in leveled areas have been lost in the last 50 years. The preserved steppes on the slopes of river valleys and ravines are of scientific value. Petrophytic communities with unique flora are widespread here. We set a goal to study the petrophyte flora and vegetation on the territory of some natural monuments of regional importance in the High Zavolzhye (within the Samara oblast). The objectives of the study were: to analyze natural monuments of the Samara oblast for the presence of petrophytic flora and vegetation; to identify rare petrophytic species that are refugia flora; to study the biology and ecology, as well as structural features of their populations. According to the results - studied the flora and vegetation of 28 natural monuments of regional importance in the High Zavolzhye region. These natural sites contain up to 27% of rare petrophyte species and are flora refugiums. The status of 24 species in the region is evaluated. The results of studying the biology and ecology of rare species, as well as the structural features of their populations indicate the need to change the rarity category of some of them in the Red Book of the Samara oblast. In the territory of Samara Zavolzhye and Predvolzhye, their numbers and habitat continue to decrease, including \textit{Eriosynaphe longifolia}, \textit{Trinia hispida}, \textit{Diplotaxis cretacea}, \textit{Matthiola fragrans}, \textit{Dianthus leptopetalus}, \textit{Astragalus sulcatus}, \textit{Astragalus temirensis}, \textit{Nepeta ucranica}, \textit{Polygala sibirica}, \textit{Atraphaxis replicata}, \textit{Asperula petraea}, \textit{Ephedra distachya}.

1. Introduction

Natural and territorial complexes in the steppe and forest-steppe zones of European Russia have historically had and currently have a high resource and economic potential [1, 2]. Significant development of land for agro-industrial complex, urban and rural development, road network and other objects, including recreational purposes, has led to the destruction of the natural vegetation cover on a large area. In this regard, monitoring of natural-territorial complexes in order to identify the structural and functional organization of vegetation cover and preservation of species and cenotic diversity is relevant.

Probably the most vulnerable variant of herbaceous vegetation in the Samara Zavolzhye and wider area are petrophytic steppes. Their unique floristic complex is characterized by the content of a large number of rare plant species. The remaining areas of petrophytic steppes should be carefully surveyed and included in the system of specially protected natural areas. Their small area combined with high anthropogenic transformation raises fears of the scientific community about the possibility of preserving petrophytic variants of steppes. At the present time there is still some reserve of stability of vegetation cover, and natural-territorial complexes with an appropriate level of protection are able to
perform the role of refugia of flora and vegetation. In this regard, we set a goal to study the petrophyte flora and vegetation on the territory of some natural monuments of regional importance in the High Zavolzhye region (within the Samara oblast). The objectives of the study were: to analyze PAs of the Samara oblast for the presence of petrophytic flora and vegetation; to identify rare petrophytic species that are refugia flora; to study the biology and ecology, as well as structural features of their populations.

2. Materials and Methods

Samara Oblast is located on the border of the forest-steppe and steppe zones. In the southern part of the region the share of arable land is more than 80% of the area, and taking into account other economic and industrial facilities - more than 95%. In the north of the region, including in the geomorphological province of High Zavolzhye, which is a spur of the Bugulma-Belebey Upland the hilly and elevated relief always had little exposure to anthropogenic influence, so, many of its natural-territorial complexes have preserved natural flora and vegetation. However, even there are only few preserved steppe areas. More important is the role of these natural-territorial complexes in the protection of flora, including unique communities of petrophytic steppes [3-8].

On the surface, sediments of the Quaternary system, Neogene, as well as rocks of the Upper Permian system (Kazan and Tatar tiers). Topography is characterized by many ridges and elevations (syrtes), and the natural-territorial complexes have petrophytic communities.

The Samara Predvolzhye, which includes the province of Samarskaya Luka, differs in geomorphology and topography. Limestone slopes of Zhiguli bear petrophytic vegetation, characterized by a higher degree of conservation in comparison with Samara Predvolzhye. The basis of the ecological framework here is represented by the Reserve, the National Park and the Middle Volga Biosphere Reserve. Besides, petrophyte steppes of Samara Predvolzhye have been historically better studied scientifically.

The authors compiled detailed floristic lists and performed field descriptions of plant communities in various natural-territorial complexes. Plant communities were studied using methods based on the dominant classification [9]. The influence of human economic activity was taken into account when describing vegetation. The geobotanical profiles were also described along with the description of the sample areas and the description of the location. Herbarium was collected if it was necessary to determine the species more accurately. Thirty specimens were collected and are stored in the herbarium Samara State University of Social Sciences and Education. In the cameral period, the collected data were analyzed, plant species affiliation was clarified, and earlier herbarium collections were analyzed.

Many registered representatives of the petrophyte flora are included in the Red Book of the Samara Oblast [4], among them: Allium delicatum Siev. ex Schult. ex Schult. fil., A. inderiense Fisch. ex Bunge et Schult., A. tulipifolium Lede., Artemisia salsoloides Willd., Asparagus inderiensis Blume ex Ledeb., As. pallasii Misch., Anthemis trotzkiana Claus, Alyssum lenense Adams, Atraphaxis frutescens (L.) K. Koch, At. replicata Lam., Asperrula petraea V.I. Kreez. ex Klokov, Astragalus cornutus Pall., Ast. helnii Fisch. Ex DC., Ast. macropus Bunge, Ast. sulcatus L., Ast. temirensis Popov, Ast. tenuifolius L. [Ast. scopaeformis Ledebr.], Ast. ucrainicus Popov et Klokov, Ast. wolgensis Bunge, Ast. zingeri Korsh., Cephalaria uralensis (Murr.) Schrad. ex Roem. et Schult., Cerastium zhiguliense Saksonov, Clausia aprica (Stephan) Korn.-Tr., Crambe tataria Sebeok, Diplotaxis cretacea Kotov, Dianthus acicularis Fisch. ex Ledeb., D. leptopetalus Willd., D. volgicus Juz., Eriosynaphe longifolia (Fisch. ex Spreng.) DC., Eremogone koriniana (Fisch. ex Fenzl) Ikonn., Euphorbia zhigulienis (Prokh.) Prokh., Ferula caspica M. Bieb., F. tatarica Fisch. ex Spreng., Globularia punctata Lapeyr., Iris pumila L., Goniolimon elatum (Fisch. ex Spreng.) Boiss., Gypsophila juczczukii Ikonn., G. zhugulensis Krasnova, Hedysarum gmelini Ledebr., H. grandiflorum Pall., H. razoumovianum Fisch. et Helm, Helianthemum nummularium (L.) Mill., Hel. zhuguliense Juz. ex Tzvelev, Hylotelephium zhugulense Tzvelev, Jurinea ledebourii Bunge, Koeleria sclerophylla P.A. Smirn., Lepidium coronopifolium Fisch. ex Ledeb., L. crassifolium Waldst. ex Kit., Matthiola fragrans Bunge, Linum
The representatives of petrophyte flora make up from 10% to 13.5% of all species registered in those complexes. Petrophytic communities, which include the studied representatives, occupy small areas in the studied protected areas. Such phytocenoses have weak projective coverage and take a long time to recover from anthropogenic disturbance of their habitats.

3. Results

Studies have repeatedly emphasized the connection and structural and functional unity of the petrophyte steppes of the Volga Upland, including those in the Zhiguli Mountains, and the High Zavolzhye region. However, insufficient attention is paid to the protection of steppe complexes in the Trans-Volga region. Undoubtedly, the modern stage of steppe protection should be a turning point. And in the modern period they have a refugium role in the preservation of petrophyte phytodiversity [3, 8].

Meanwhile monitoring of 28 such specially protected natural areas in the Samara Trans-Volga region, it was found that the species composition and abundance of rare representatives of petrophyte flora vary significantly, depending on the degree of anthropogenic transformation of the territory.

Good preservation of petrophyte flora and vegetation belongs to such natural-territorial complexes of Samara Oblast as, for example, the conservation areas of "Kamennye loga" (35.3 ha), "Sestrinskiye fossils" (255.66 ha), "Site of tipcha-coarse virgin steppe" (932 ha), "Site of bald-grass-meadow virgin steppe" (932 ha), "The Baikal true steppe" (188.8 ha), "Kirovskaya steppe" (134 ha) and "Preobrazhenskaya steppe" (3270 ha), "Balka Lozovaya" (82.3 ha), "Mulin Dol" (5,090 ha), "Koshkinshkaya Balka" (320 ha), "Kladovaya Balka" (385.5 ha), "Sarbaisky forest-steppe" (510.72 ha), "Tsar's Mound" (13.7 ha), "Igonev Dol" (72.0 ha), "Isaklinsky upland forest-steppe" (288 ha) and the tracts "Pionerka Mountain" (65 ha), "Krasnaya Mountain" (45 ha), "Gora Kopeika" (221.6 ha), "Gora Lysaya" (268 ha), "Sokolgi mountains and the bank of the Volga between Studenoy and Koptev ravines" (395 ha), "Gora Krasnaya" (395 ha), "Gora Vysokaya" (163 ha), "Sernovodskiy Shyan" (30 ha), "Verkhovoy ravine" (72 ha), "Alakaevsko-Chubovskaya stony steppe" (5 ha) and "Chubovskaya steppe" (67 ha).

The representatives of petrophyte flora make up from 10% to 13.5-14% and up to a maximum of 27% of all species registered in those complexes. Petrophytic communities, which include the studied representatives, occupy small areas in the studied protected areas. Such phytocenoses have weak total projective coverage and take a long time to recover from anthropogenic disturbance of their habitats.

The dominant species in petrophytic phytocenoses are representatives of the genera Stipa, Artemisia, Thymus, Koeleria, and often also species of motley grasses – Atraphaxis frutescens, Astragalus macropus, Ast. tenuifolius, Astragalus wolgensis, Ferula caspica, Globularia punctata, Hedysarum grandiflorum, H. razoumovianum, Linum flavum, Oxytropis floribunda, Palimbia turgaica.

Assessment of transformation of vegetation cover of petrophyte steppes under anthropogenic load, first of all cattle grazing, shows that 40% of them are exposed to weak load, 45% - to medium load, 15% - represent absolutely disrupted communities. The vulnerability of communities due to the
peculiarities of soil cover in inclined landscapes requires a more thorough study of petrophyte steppes and a clear organization of nature protection measures.

Extensive work to identify the parameters of natural cenopopulations of rare plant species of petrophytic communities in different habitat conditions, including anthropogenic transformation of the vegetation cover, allowed us to determine the response of species to the effects of various factors and the reflection of this impact on the structural features of cenopopulations.

In the petrophyte communities of protected areas, a significant decrease in the number of individuals was noted in these species Eriosynaphe longifolia, Pleurosporum uralense, Trinia hispida, Anthemis trotzkiana, Rindera tetraspis, Clausia aprica, Diplotaxis cretacea, Matthiola fragrans, Dianthus leptopetalus, Helianthemum nummularium, Helianthemum zheguliense, Astragalus sulcatus, Astragalus temirensis, Astragalus ucrainicus, Medicago cancellata, Nepeta ucranica, Thymus dubjanskyi, Thymus zheguliensis, Linum uralense, Polygala sibirica, Atraphaxis frutescens, Atraphaxis replicata, Asperula petraea, Ephedra distachya. The main factors that caused a fairly sharp decline in the number of species are steppe fires, overgrazing, and recreational impact. This indicates insufficient protection of species in the study area requires better implementation of environmental legislation and regulation of the impact on natural complexes.

Anthropogenic transformation of vegetation cover affects the structure of petrophyte steppes. Peculiarities of self-restoration processes and self-maintenance in populations ensure the sustainability of rare species in the region. The self-renewal ability of populations depends on the real seed productivity, seed bank availability in the soil, germination intensity, resistance of young individuals to various influences and death of seedlings, the duration of the pregenerative period and many other parameters. Some of the characteristics studied are shown in table 1.

Table 1. Bioecological features of rare species of petrophytic steppes.

| №  | species                          | Duration of ontogenesis, years | Duration of reaching the generative phase, years | Fulfillment of the seeds, % | Laboratory germination of seeds, % |
|----|---------------------------------|-------------------------------|-------------------------------------------------|----------------------------|-----------------------------------|
| 1  | Eriosynaphe longifolia          | 3                             | 1                                               | 20.6                       | 53.0                              |
| 2  | Pleurosporum uralense           | 3                             | 2                                               | 40.4                       | 33.4                              |
| 3  | Trinia hispida                  | 3                             | 2                                               | 20.8                       | 80.2                              |
| 4  | Anthemis trotzkiana             | 14                            | 6                                               | 32.1                       | 21.1                              |
| 5  | Rindera tetraspis               | 8                             | 3                                               | 33.7                       | 12.3                              |
| 6  | Clausia aprica                  | 6                             | 3                                               | 60.3                       | 25.9                              |
| 7  | Diplotaxis cretacea             | 5                             | 3                                               | 40.2                       | 13.9                              |
| 8  | Matthiola fragrans              | 11                            | 4                                               | 39.4                       | 28.7                              |
| 9  | Dianthus leptopetalus           | 9                             | 4                                               | 45.8                       | 32.9                              |
| 10 | Helianthemum nummularium        | 10                            | 5                                               | 26.3                       | 16.5                              |
| 11 | Helianthemum zheguliense        | 10                            | 4                                               | 40.5                       | 20.7                              |
| 12 | Astragalus sulcatus             | 12                            | 6                                               | 28.9                       | 60.3                              |
| 13 | Astragalus temirensis           | 13                            | 5                                               | 33.6                       | 63.1                              |
| 14 | Astragalus ucrainicus           | 10                            | 5                                               | 52.3                       | 56.7                              |
| 15 | Medicago cancellata             | 12                            | 3                                               | 45.1                       | 65.2                              |
| 16 | Nepeta ucranica                 | 5                             | 3                                               | 30.5                       | 63.8                              |
| 17 | Thymus dubjanskyi               | 14                            | 9                                               | 28.6                       | 23.9                              |
| 18 | Thymuszheguliensis              | 12                            | 9                                               | 33.1                       | 11.9                              |
| 19 | Linum uralense                  | 11                            | 6                                               | 45.9                       | 54.3                              |
| 20 | Polygala sibirica               | 8                             | 3                                               | 23.9                       | 28.3                              |
| 21 | Atraphaxis frutescens           | 16                            | 7                                               | 29.4                       | 53.1                              |
| 22 | Atraphaxis replicata            | 11                            | 3                                               | 36.1                       | 20.4                              |
| 23 | Asperula petraea                | 14                            | 5                                               | 16.8                       | 20.3                              |
| 24 | Ephedra distachya               | 35                            | 12                                              | 83.1                       | 33.9                              |
All data in the table are given only for model individuals. Evaluating the difference in the maximum duration of ontogenesis of individuals and the average values, it is necessary to point out a significant difference between them (differing by 2-3 times). Often the average lifespan of individuals that have safely survived the initial stages of ontogenesis, who have reached the immature or virginile state, for various reasons die just as they reach the generative state. This is usually due to the action of the pyrogenic factor, leading to the almost complete destruction of individuals. Young plants are destroyed to a greater extent by the development of slope erosion, trampling by farm animals, and recreational use of areas.

The results of studying the features of reproductive activity of individuals in natural populations of the Samara oblast indicate different types of species strategies. High plumpness of seeds is characteristic only of some representatives Clausia aprica, Ephedra distachya (over 60%). However, the laboratory germination of seeds of these species is about 30%.

Low seed fulfillment is noted in Eriosynaphe longifolia, Trinia hispida, Asperula petraea, Polygala sibirica is about 20%. The rest of the species have average rates of seed plumpness.

Seed regeneration should be recognized as weakly effective in Anthemis trotzkiana, Rindera tetraspis, Matthiola fragrans, Helianthemum nummularium, Polygala sibirica, Asperula petraea – have low rates of seed plumpness and germination. With a small number of generative individuals in populations under moderate to high anthropogenic load, species quickly lose their positions in the phytocenosis and often disappear completely.

Table 2 provides information on the population structure of rare species of petrophytic steppes in the region. Features of ontogenetic and spatial structure of cenopopulations can act as diagnostic signs of express-evaluation of the state of petrophyte steppes of Samara Zavolzhye and Predovolzhye, as well as used in other parts of the range of these representatives.

Table 2. Peculiarities of populations of rare species of petrophytic steppes.

| №  | species                                  | The predominant ontogenetic group of individuals | Share of generative individuals, % | Total density of individuals, ind./m² | Category in the Red Book [4] | Recommended category |
|----|------------------------------------------|-------------------------------------------------|-----------------------------------|--------------------------------------|-------------------------------|----------------------|
| 1  | Eriosynaphe longifolia                   | mature generative                               | 68.9                              | 0.35                                 | 3                             | 2                    |
| 2  | Pleurospermum uralense                    | virginile                                       | 77.5                              | 0.29                                 | 2                             | 2                    |
| 3  | Trinia hispida                           | mature generative                               | 56.9                              | 0.14                                 | 3                             | 2                    |
| 4  | Antheimis trotzkiana                     | old generative                                  | 58.3                              | 0.11                                 | 1                             | 1                    |
| 5  | Rindera tetraspis                        | mature generative                               | 66.2                              | 0.23                                 | 1                             | 1                    |
| 6  | Clausia aprica                           | virginile                                       | 59.1                              | 1.79                                 | 3                             | 3                    |
| 7  | Diplotaxis cretacea                      | mature generative                               | 65.9                              | 0.56                                 | 4                             | 3                    |
| 8  | Matthiola fragrans                       | old generative                                  | 73.6                              | 0.07                                 | 3                             | 2                    |
| 9  | Dianthus leptopetalas                    | old generative                                  | 78.3                              | 0.32                                 | 3                             | 2                    |
| 10 | Helianthemum nummularium                 | mature generative                               | 71.6                              | 1.06                                 | 3                             | 3                    |
| 11 | Helianthemum zheguliense                 | mature generative                               | 56.3                              | 0.95                                 | 3                             | 3                    |
| 12 | Astragalus sulcatus                      | mature generative                               | 87.2                              | 0.55                                 | 3                             | 2                    |
| 13 | Astragalus temirensis                    | mature generative                               | 69.7                              | 3.08                                 | 3                             | 2                    |
| 14 | Astragalus ucrainicus                    | mature generative                               | 86.4                              | 2.36                                 | 3                             | 3                    |
| 15 | Medicagocancellata                      | mature generative                               | 51.8                              | 1.02                                 | 3                             | 3                    |
| 16 | Nepeta ucranica                          | mature generative                               | 66.3                              | 0.67                                 | 5                             | 3                    |
| 17 | Thymus dubjanskyi                        | mature generative                               | 68.4                              | 1.40                                 | 3                             | 3                    |
| 18 | Thymus argumentes                        | mature generative                               | 75.3                              | 1.35                                 | 3                             | 3                    |
| 19 | Linum uralense                           | mature generative                               | 55.6                              | 2.45                                 | 3                             | 3                    |
| 20 | Polygala sibirica                        | mature generative                               | 61.0                              | 3.68                                 | 3                             | 2                    |
| 21 | Atraphaxis frutescens                    | mature generative                               | 76.2                              | 2.12                                 | 3                             | 3                    |
| 22 | Atraphaxis replicata                     | mature generative                               | 64.4                              | 0.26                                 | 3                             | 2                    |
| 23 | Asperula petraea                         | old generative                                  | 73.9                              | 3.56                                 | 4                             | 2                    |
| 24 | Ephedra distachya                        | old generative                                  | 85.6                              | 2.64                                 | 3                             | 2                    |
In general, the predominant ontogenetic group of individuals in the composition of rare species cenopopulations is the mature generative group. For cenopopulations *Anthemis trotzkiana*, *Matthiola fragrans*, *Dianthus leptopetalus*, *Asperula petraea*, *Ephedra distachya* the dominance of the generative group of individuals was noted. In *Pleurospermum uralense*, *Clausia aprica* the predominance of virginia plants was observed in the ontogenetic spectra of cenopopulations.

Despite the diversity of ontogenetic spectra of cenotic populations, a high content of individuals capable of performing the generative function was noted for all species. The number of generative plants of more than 80% is characteristic of *Astragalus ucrainicus* and *Ephedra distachya*. More balanced ontogenetic spectra, in which the proportion of generative plants is 50-60%, are observed in *Trinia hispida*, *Anthemis trotzkiana*, *Clausia aprica*, *Helianthemum zheguliense*, *Medicago cancellata*, *Linum uralense*, *Polygala sibirica*. In this case, it is necessary to estimate the correlation between the ontogenetic spectrum and the total abundance of a particular species, which will more clearly show the state of the cenopopulations. Higher rates of self-healing have *Clausia aprica*, *Helianthemum zheguliense*, *Astragalus ucrainicus*, *Medicago cancellata*, *Linum uralense*.

A very low density of individuals (less than 0.5 individuals per 1 m²) was observed in cenopopulations of a large number of representatives. In some species this is quite natural due to the large size of their individuals (*Eriosynaphe longifolia*, *Pleurospermum uralense*). But this low density is mainly due to the ecological and phytocenotic conditions of habitats and anthropogenic impact.

The spatial pattern of populations of rare species depends on various factors, both the ecological and phytocenotic conditions of habitats and the biological features of species. It is precisely individuals of species characterized by low densities that are randomly distributed in communities. In most species (*Rinderia tetraspis*, *Clausia aprica*, *Diplotaxis cretacea*, *Matthiola fragrans*, *Dianthus leptopetalus*, *Helianthemum nummularium*, *Helianthemum zheguliense*, *Astragalus temirensis*, *Astragalus ucrainicus*, *Medicago cancellata*, *Nepeta ucranica*, *Thymus dubjanskyi*, *Thymus zheguliensis*, *Linum uralense*, *Polygala sibirica*, *Atraphaxis frutescens*, *Atraphaxis replicata*, *Asperula petraea*, *Ephedra distachya*) group placement of individuals is observed (sometimes a combination of group and random placement is noted).

The results of the study of populations and biology of species allowed us to assess the current status of rare petrophytes in the region and to estimate the current category of rarity. In the current list of the Samara Region Red Data Book [4], most of the species listed in tables 1 and 2 have the rarity status "3 - rare species". A smaller number of the studied species include taxa with the rarity category "1 - endangered", "2 - decreasing in abundance and/or distribution", "4 - uncertain status", and "5 - recoverable and recovering".

A study of the bioecological characteristics of species and peculiarities of the structure of their cenopopulations shows the need to change the rarity category for the following species: *Eriosynaphe longifolia*, *Trinia hispida*, *Diplotaxis cretacea*, *Matthiola fragrans*, *Dianthus leptopetalus*, *Astragalus sulcatus*, *A. temirensis*, *Nepeta ucranica*, *Polygala sibirica*, *Atraphaxis replicata*, *Asperula petraea*, *Ephedra distachya*. These species require a more thorough study and optimization of conservation measures in their habitats. One of the ways is to increase the area of specially protected natural territories at the expense of preserved steppe areas with a high content of rare species.

The most accessible form of biodiversity reserves in the region can be conservation areas of regional importance (or their rank can be higher), which area is conceived to be small (on average 50-300 ha), but they cover the main locally preserved natural complexes. Most of the specially protected natural territories are located in the northern (forest-steppe) part of the region and have a complex character (the objects of protection are natural objects characterized by the presence of steppe, forest, meadow and water communities). The southern (steppe) part of the region in connection with the long use of the territory as arable land does not have sufficient protected areas for solving the main ecological problems. In general, in the Samara Oblast, despite the presence of a nature reserve and a national park, the problem of lack of facilities in the network of specially protected natural areas.
remains at the present time. In this regard, it is necessary to search for and allocate new conservation areas.

4. Conclusion
All existing specially protected natural areas that were studied confirmed their importance as refugia of flora and represent important natural objects in the preservation of phytodiversity (considered in Samara Trans-Volga). In those areas, the share of rare and vulnerable representatives of flora is from 3 to 27%. The number and abundance of rare plant species in the flora of the surveyed conservation areas of regional importance directly depend on the degree of anthropogenic transformation of the vegetation cover.

The results of the study of biology, ecology and structure of cenopopulations of 24 rare species are presented. Studies of the biology of rare species show a weak regenerative capacity of many of them, especially under anthropogenic transformation of phytocenoses in the conditions of the Samara oblast. To enhance the conservation of species such as *Anthemis troitzkiana*, *Rindera tetraspis*, *Matthiola fragrans*, *Helianthemum nummularium*, *Polygala sibirica*, *Asperula petraea* in the petrophytic steppes of southeastern Russia requires more significant efforts and clearly organized conservation measures. Most natural-territorial complexes with petrophytic groups in their composition require not just regulation, but a significant reduction of recreational and economic pressures.

Sufficiently high capacity for self-maintenance and self-renewal of populations in the Samara Zavolzhye and Predovolzhye show *Clausia aprica*, *Helianthemum zheguliense*, *Astragalus ucrainicus*, *Medicago cancellata*, *Linum uralese*.

The obtained data on the structure of cenopopulations allowed us to recommend a change in the category of rarity for some species in the Red Book of Samara oblast. Unfortunately, at present, populations of many species continue to decline in numbers and range, including *Eriosynaphe longifolia*, *Trinia hispida*, *Diplotaxis cretacea*, *Matthiola fragrans*, *Dianthus leptopetalus*, *Polygala sibirica*, *Atraphaxis replicata*, *Asperula petraea*, *Ephedra distachya*.

Due to the fact that in the agricultural regions of the European part of Russia in steppe and forest-steppe zones it is impossible to create large nature reserves, ecologists have long proposed the formation of a unified and continuous network of small and medium-sized specially protected natural areas. This should be based on the degree of representativeness of natural landscapes, the typicality of objects for the region, their uniqueness, the presence of a threat of extinction, the value of the object as a refugium for the conservation of the gene pool of flora.

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