

Structure and dynamics of the flora of protected areas (on the example of the Mordovia State Nature Reserve, European Russia)

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Abstract

Our research, which has yielded unique findings, is dedicated to the study of the dynamics of the number of flora species in a forest-protected area (Mordovia State Nature Reserve, European Russia) for the period 1936-2023. During this period, there was an increase in the number of species of both native (from 525 to 695 species) and alien (from 38 to 174 species) flora. Based on the above data, we conclude that the composition of the native flora of the MSNR is more than 99% identified. In the first years of the flora inventory, about 70% of the native flora is identified. The spectrum of families of the native flora of the MSNR has changed little over time. After the first inventory, the number of families in the flora does not add up to much (78 in 1936, 87 in 2023). There is mainly an increase in the number of identified genera in already known families and species within identified genera. In the spectrum of families of alien flora there are constant changes, new genera from different families, species within genera are added. The floristic data analysis revealed that the natural flora exhibited characteristics of a forest, despite the presence of a forest-steppe zone adjacent to the southern border of the MSNR. The primary indicators of systematic structure, composition of life forms, and ranges of species of native flora collectively indicate that the Mordovia State Nature Reserve forest area is situated within the natural zone of mixed (coniferous-broadleaved) forests. A comparison of long-term data from the MSNR flora study revealed that the process of formation of the alien flora of the MSNR, its structure, and chorological groups has not been completed yet. It will continue until the cultivation of plants from different continents and natural areas in protected areas is banned.

Keywords: biodiversity, Republic of Mordovia, rare species, vascular plants

Introduction

The first stage of all botanical research is the flora inventory. Studying the floristic composition of any territory or water area can require different periods of time. Changes in the flora can be assessed by comparing species lists compiled at intervals of ten years (Gaston et al., 2008; Seregin, 2012) or more. Floristic analysis data are used for maintaining flora cadasters, red and black lists, organization and management of specially protected natural areas, hunting farms, etc. The model objects for long-term floristic studies are less disturbed natural allotments – protected areas (Seregin, 2012; Mendoza-Fernandez et al., 2014; Pospelov & Pospelova, 2016; Tzonev et al., 2019; Gamova, 2022; Kearney et al., 2020; Saberamoli et al., 2021; Amiri et al., 2022; Gamova & Korotkov, 2024) and biological stations (Khapugin & Silaeva, 2020). In Russia, reserves, including the Mordovia State Nature Reserve (MSNR), have a long history of floristic research. The flora of the MSNR was initially studied by N.I. Kuznetsov, a florist and botanical-geographer, between 1936 and 1940 (Kuznetsov, 1960). In 1966, a permanent staff of five botanists was established at the Mordovia State Reserve. As a result of the inventory work they prepared the second annotated list of the flora of the Mordovia State Reserve (Borodina et al., 1987). The third period of the study of the MSNR flora began in 2009, when the previous generation of botanists was completely replaced by young active botanists. In 2016, they published an updated annotated list of the MSNR flora based on the results of their work and the accumulated data (Tereshkina, 2000, 2006; Khapugin et al., 2012, 2013a,b; Vargot et al., 2016). Six qualified botanists have visited the reserve over the past 15 years. Since the publication of the third annotated list, several additions have been made to the MSNR flora (Ershkova & Sosnina, 2019; Esina et al., 2021; Esina & Ershkova, 2021; Khapugin et al., 2021; Verkhovzina et al., 2022, 2024; Ershkova et al., 2023), and the structure of the alien flora has been analyzed (Esina et al., 2022). Therefore, the aim of the present research was to study the structure and dynamics of the MSNR flora over the entire period of its functioning. The objectives of the research were to identify the systematic, morphological, chronological, and ecological-phylogenetic structure of the MSNR flora and to compare some systematic parameters of the MSNR flora chronologically.

Material and methods

Study area

The Mordovia State Nature Reserve is situated in the center of the Russian Plain in the southeastern part of the Oksko- Klyazminskoye or Mokshinskoye Polesie, which is a southeastern extension of the Meshcherskoye Polesie (Tereshkina et al., 2020). The MSNR has an area of 321.48 km². The Mordovia Reserve's central estate is in Pushta settlement (54.715119° N, 43.224883° E). Most of the area of the MSNR is covered with forests. The southern part of the protected area borders on a

forest-steppe (Fig. 1). The hydrographic network is represented by the rivers Moksha, Satis, Pushta, Arga, Sarovka, Glinka and other small watercourses, as well as floodplain lakes, ponds, swamps of the upper, transitional and lowland types. The predominant soil types are podzolic, gray forest, gley, and alluvial soils. The vegetation cover consists of 2/3 coniferous forests (*Pinus sylvestris* L., *Picea abies* L.), coniferous-leaved forests (*Pinus sylvestris* L., *Picea abies* L., *Tilia cordata* Mill., *Betula pendula* Roth., *Populus tremula* L.) and small-leaved forests (*Betula pendula*, *Populus tremula*). Small areas are occupied by oak (*Quercus robur* L.), spruce (*Picea abies*), and black alder (*Alnus glutinosa* (L.) Gaertn.) forests. 1/3 of the MSNR is covered by young hardwood stands (*Betula pendula*, *Populus tremula*, *Tilia cordata*) on the site of the 2010 and 2021 extensive fires. Sphagnum (*Sphagnum* ssp.), sedges (*Carex* ssp.), heaths (*Ledum palustre* L., *Chamaedaphne calyculata* (L.) Moench, *Andromeda polifolia* L., *Vaccinium oxycoccus* Poir.) and various hygrophytes grow on the swamps. The meadow vegetation was formed in the floodplain of the Moksha River in clearings on the site of former cordons. Groups of weedy and alien plant species can be found in Pushta settlement, on the territory of 15 cordons and three winter camps, along forest roads and glades, on the railway's embankment in the northeast of the MSNR.

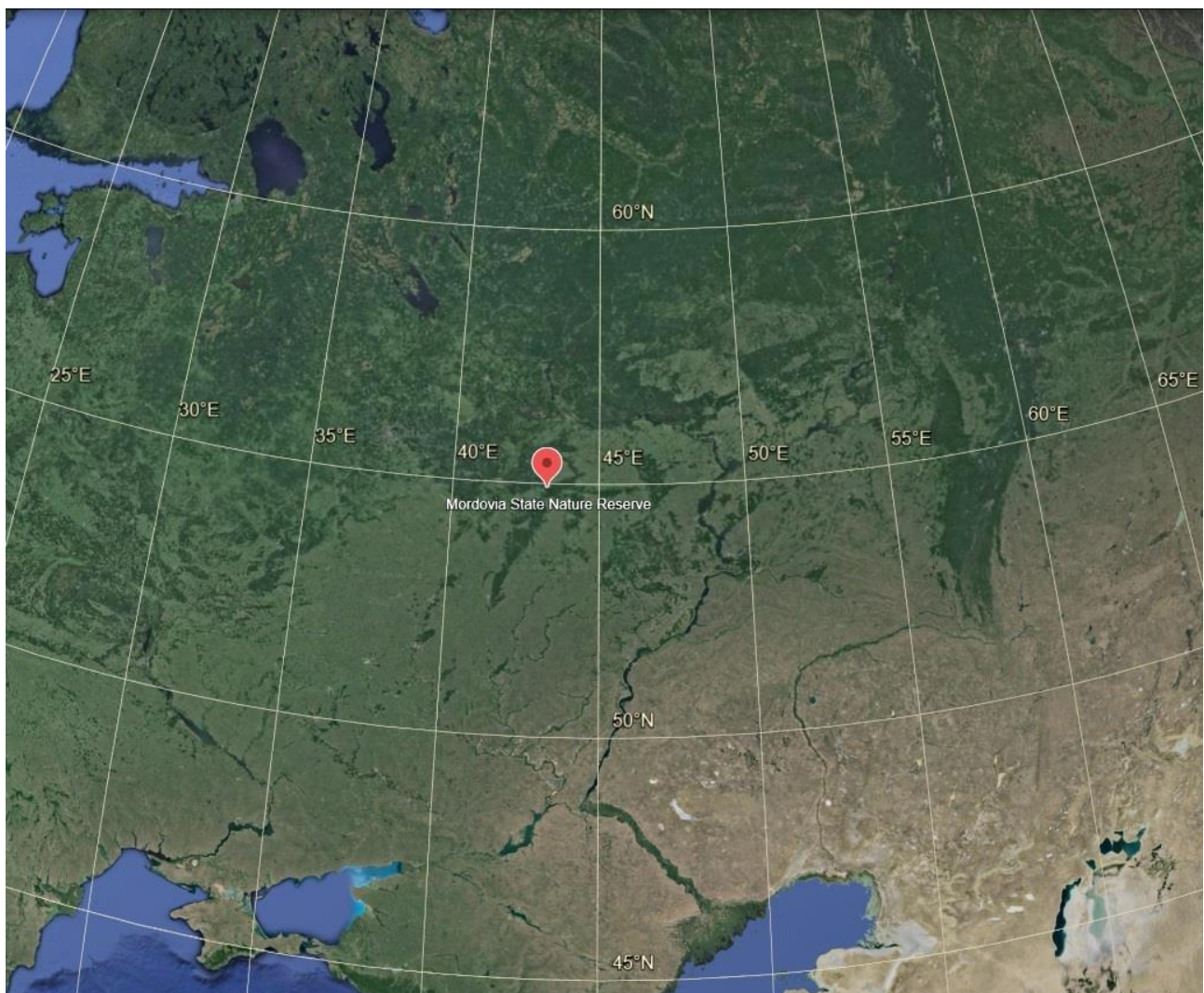


Figure 1. Location of the Mordovia State Nature Reserve**Material and methods**

The present study is based on materials from three floral abstracts of the MSNR (Kuznetsov, 1960; Borodina et al., 1987; Vargot et al., 2016), a herbarium collection of HMNR, partly – MW and GMU (Thiers, 2022), and the authors' own data published in separate articles (Khapugin et al., 2021, 2023; Ershkova & Sosnina, 2019; Sosnina et al., 2019; Esina et al., 2021a,b; Ershkova & Esina, 2021; Ershkova et al., 2023; Esina, 2023; Verkhovina et al., 2022, 2024). Researchers of the MSNR flora traveled a network of branched routes through the forest area, minor rides, and dirt roads, covering the entire diversity of MSNR biotopes (Kuznetsov, 1960; Borodina et al., 1987; Vargot et al., 2016). The field material of the authors of this article was collected from 2009–2023 while following different routes in forest blocks of the MSNR, water bodies, and swamps in anthropogenic habitats. During our research, we collected a herbarium kept in the Herbarium Mordovia State Nature Reserve (HMNR). A number of findings of native and alien flora are documented by photographic observations posted on the iNaturalist platform, <https://www.inaturalist.org/> (Esina et al., 2021b; Khapugin et al., 2021; Verkhovina et al., 2021, 2024; Ershkova et al., 2023).

Data analysis

We summarized the data from the above sources on the number of native and alien species in the form of a Microsoft Excel spreadsheet (Microsoft Office 2016, v. 14.0.6023.1000) to obtain a total floristic list of the MSNR. In this spreadsheet, the systematic affiliation (species, genus, family, class, phylum) (POWO, 2024), biotypes (Raunkiaer, 1934), longitude and latitude range groups, and characteristic habitat type were indicated for each species. Then we analyzed the systematic, biotype, chronological and ecological-phylogenetic structure of the flora (Shmidt, 1984), and summarized data on the dynamics of the number of species, genera, and families for four periods of floristic studies – 1936-1940 (Kuznetsov, 1960), 1966-1987 (Tsinger, 1966; Borodina et al., 1987), 1988-2016 (Tereshkina, 2000, 2006; Khapugin et al., 2012, 2013; Sennikov et al., 2012; Kucherov et al., 2016; Vargot et al., 2016), 2017-2023 (Khapugin, 2017; Ershkova & Sosnina, 2019; Sosnina et al., 2019; Esina et al., 2021a,b,c; Ershkova & Esina, 2021; Ershkova et al., 2023; Esina, 2023; Verkhovina et al., 2022, 2024). Only species reliably recorded in the area of the MSNR were included in the flora analysis. We did not consider species that were known to occur in the vicinity of the reserve and within its former protection zone.

Results

A comprehensive analysis of the available data revealed that the MSNR flora currently includes 869 species from 367 genera and 95 families. Of these, 695 are native species, and 174 are alien species.

Changes in the ratio of species, genera, and families in the MSNR flora during different periods of floristic studies are summarized in Table 1 and Figures 2 and 3.

Table 1. Changes in the number of taxonomic units in the flora of the Mordovia State Nature Reserve for 1936–2023

Periods of floristic researches	Native flora						Alien flora						Flora in total					
	species		genus		family		species		genus		family		species		genus		family	
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
1936-1940	525	93	274	93	78	100	38	7	28	9	7	9	563	100	295	100	78	100
1966-1987	652	91	323	95	86	99	65	9	52	15	17	20	717	100	341	100	87	100
1988-2016	689	89	334	94	87	99	86	11	65	18	21	24	775	100	355	100	88	100
2017-2023	695	80	335	91	87	92	174	20	131	36	47	49	869	100	367	100	95	100
Total	695		335		87		174		131		47		869		367		95	

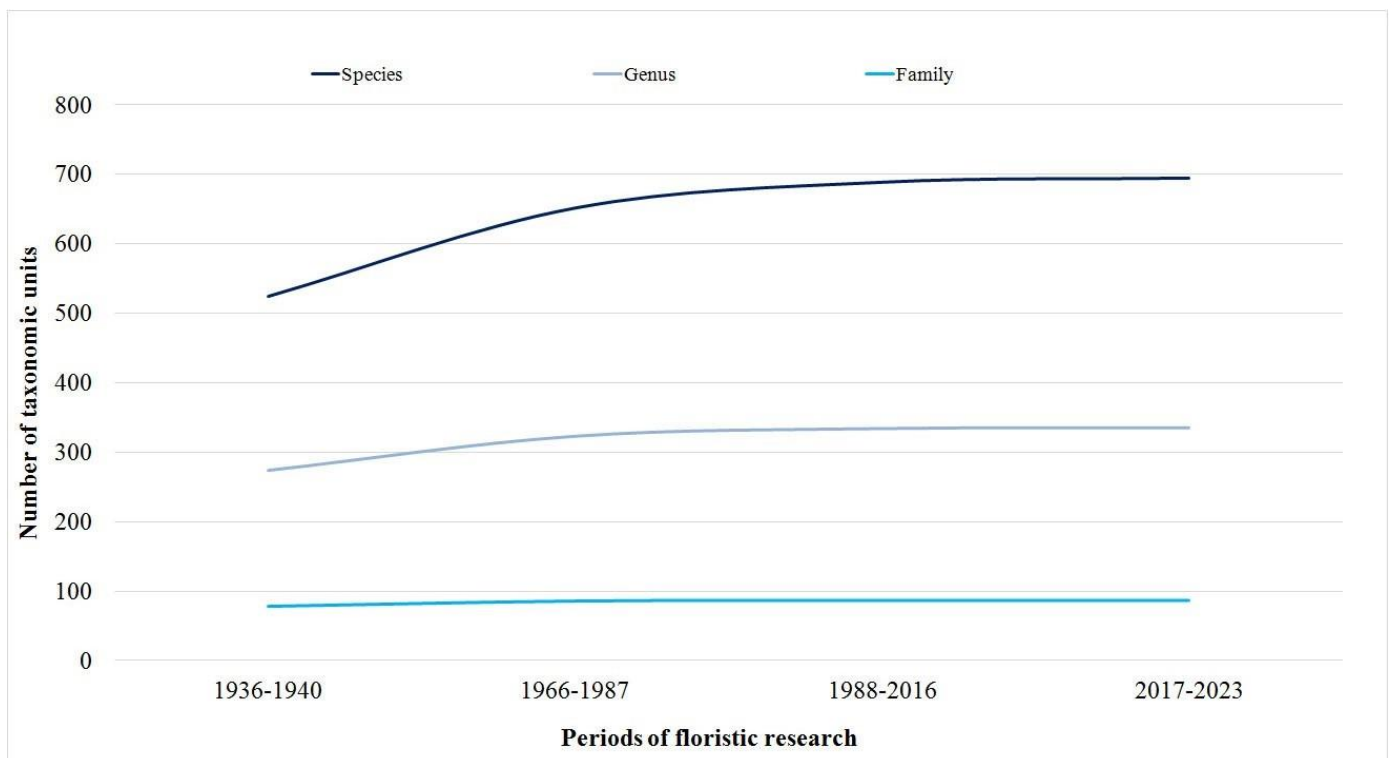


Fig. 2. Dynamics of the number of taxonomic units in the native flora of the Mordovia State Nature Reserve in 1936-2023.

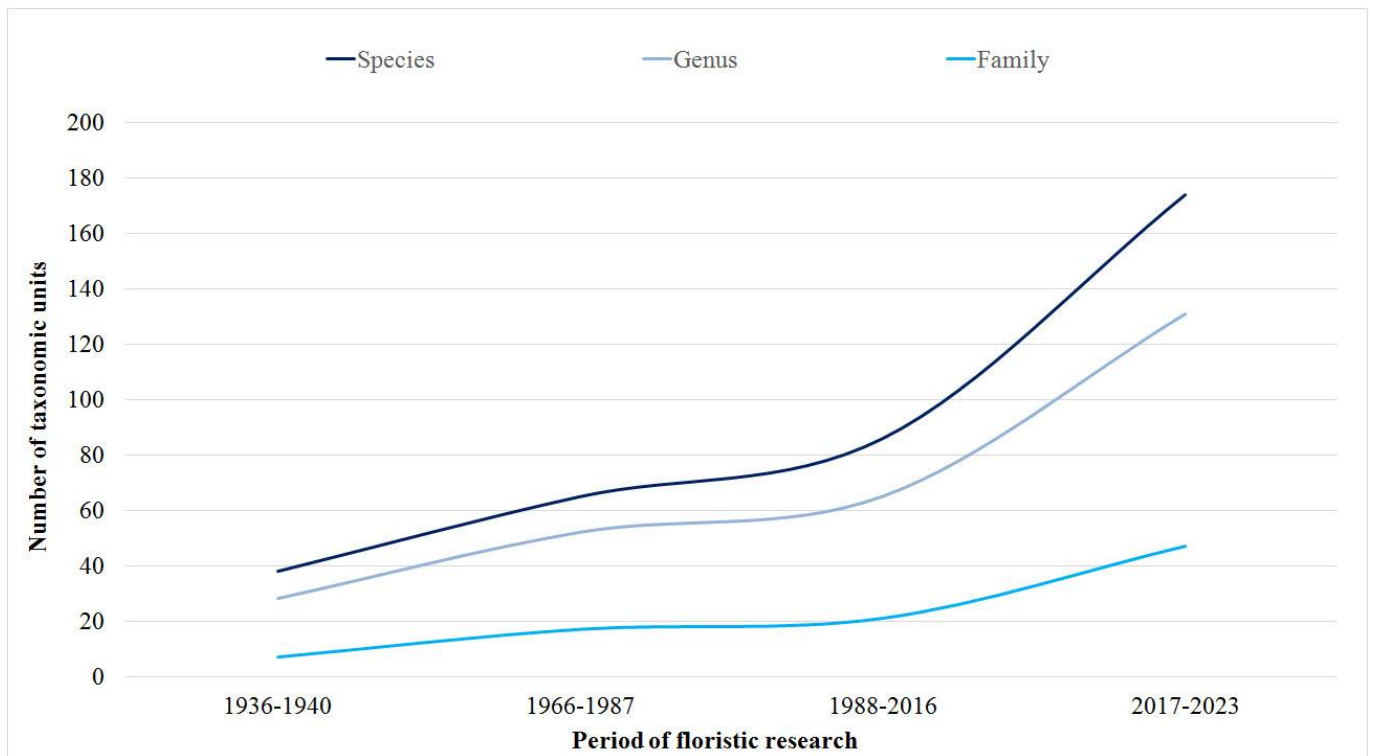


Fig. 3. Dynamics of the number of taxonomic units in the alien flora of the Mordovia State Nature Reserve in 1936-2023.

The studied flora includes higher spore and seed plant representatives (Table 2, 3).

Table 2. Taxonomic structure of the native flora of the Mordovia State Nature Reserve

Taxon	Native flora					
	Number of species	% from native flora	Number of genus	% from native flora	Number of families	% from native flora
Lycopodiopsidae	5	0.7	3	0.9	1	1.1
Equisetidae	6	0.9	1	0.3	1	1.1
Polypodiidae	11	1.6	8	2.4	3	3.4
Ophioglossidae	4	0.6	2	0.6	1	1.1
Pinopsida	3	0.4	3	0.9	2	2.3
Magnoliopsidae	666	95.8	318	94.9	79	90.8
<i>Monocots</i>	180	27.0	74	23.3	16	20.3
<i>Eudicots</i>	486	73.0	244	76.7	63	79.7
Total	695	100.0	336	100.0	87	100.0

Table 3. Taxonomic structure of the alien flora of the Mordovia State Nature Reserve

Taxon	Alien flora					
	Number of species	% from alien flora	Number of genus	% from alien flora	Number of families	% from alien flora
Lycopodiopsidae	0	0.0	0	0.0	0	0.0
Equisetidae	0	0.0	0	0.0	0	0.0
Polypodiidae	0	0.0	0	0.0	0	0.0
Ophioglossidae	0	0.0	0	0.0	0	0.0
Pinopsida	3	1.7	3	2.3	2	4.3
Magnoliopsidae	171	98.3	128	97.7	45	95.7
<i>Monocots</i>	20	11.7	16	12.5	5	11.1
<i>Eudicots</i>	151	88.3	112	87.5	40	88.9
Total	174	100.0	131	100.0	47	100.0

As illustrated in Tables 2 and 3, the MSNR flora is dominated by eudicots. It is important to note that no higher spore plants were identified as part of the alien flora of the MSNR. The families with the greatest number of species in the native flora of the MSNR (Table 4) are Compositae, Gramineae, Cyperaceae, Rosaceae, Caryophyllaceae, Fabaceae, Brassicaceae, Apiaceae, Plantaginaceae, Lamiaceae, and Polygonaceae. They represent 56.3% (391 species) of the native flora. The families Asteraceae, Rosaceae, Lamiaceae, Poaceae, Brassicaceae, Fabaceae, Onagraceae, Salicaceae, and Onagraceae occupy a leading position in the MSNR flora. They include 103 species, which is 63.4% of the total alien flora of the Mordovia Reserve (Esina et al., 2022).

Table 4. Leading families of the native flora of the Mordovia State Nature Reserve

№	Family	Number of species	
		Absolute	% of native flora
1	Asteraceae	74	10,6
2	Gramineae	60	8,6
3	Cyperaceae	49	7,1
4	Rosaceae	42	6,0
5	Caryophyllaceae	32	4,6
6	Fabaceae	28	4,0
7	Brassicaceae	23	3,3
8	Apiaceae	22	3,2
9	Plantaginaceae	21	3,0
10-11	Lamiaceae	20	2,9
10-11	Polygonaceae	20	2,9
	Total	391	56,3

Figures 4 and 5 illustrate the ratios of life forms of vascular plant species of the native and alien flora of the MSNR, as classified by C. Raunkiaer (1934).

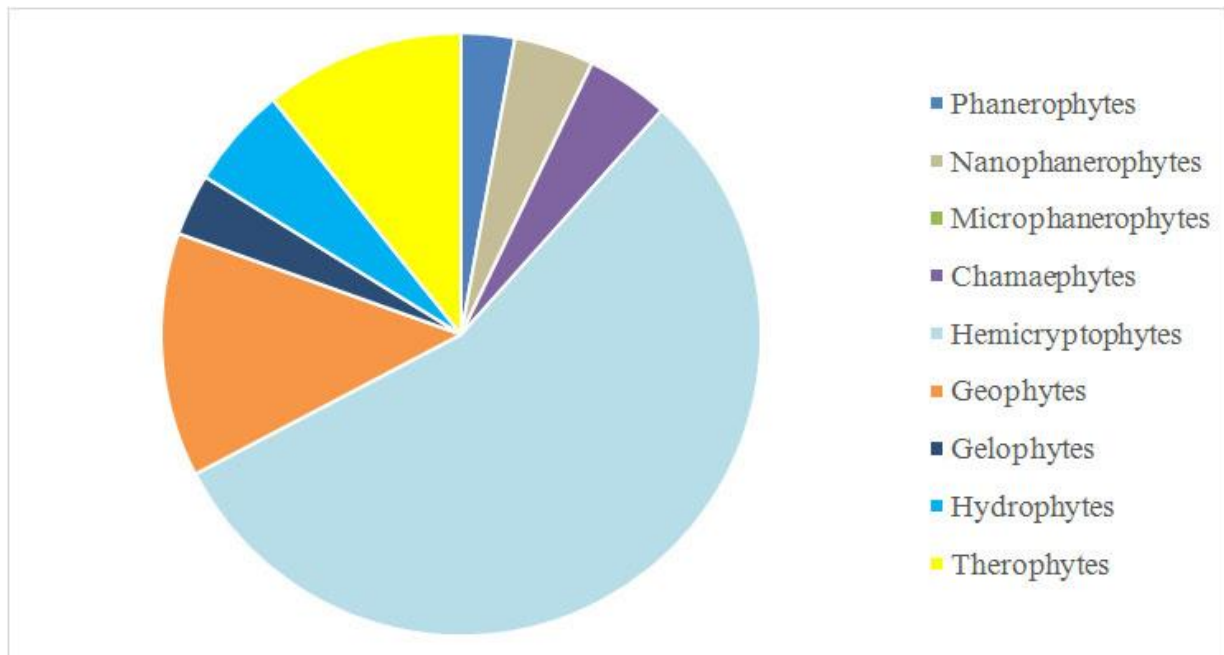


Figure 4. Life forms of plant species of the native flora of the Mordovia State Nature Reserve.

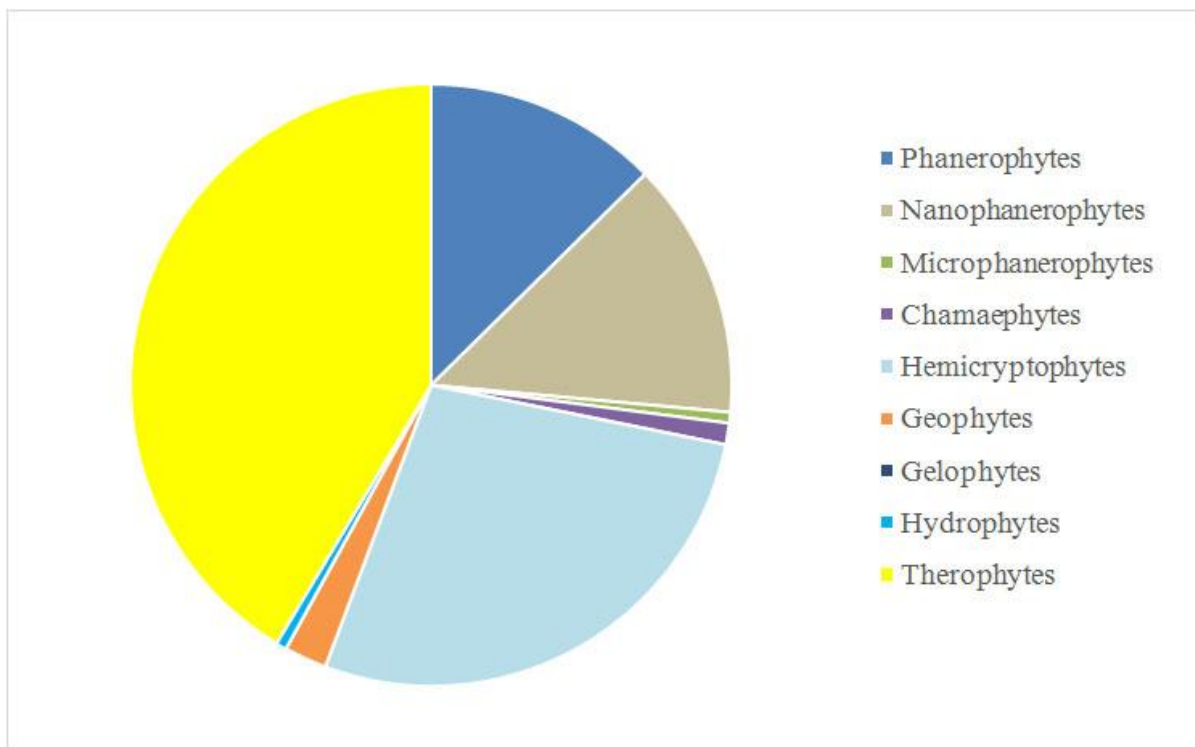


Figure 5. Life forms of plant species of the alien flora of the Mordovia State Nature Reserve.

The species of the MSNR are classified into nine groups of biotypes according to the classification of C. Raunkiaer (1934) (Figures 4, 5). Figure 4 illustrates that over half of the species of the native flora of the MSNR belong to hemicryptophytes (387 species, 55.7%), a characteristic of the floras

of numerous regions of Central Russia (Kazakova, 2004; Silaeva et al., 2010; Gafurova, 2014; Reshetnikova et al., 2010; Vasyukov & Saxonov, 2020). The other eight groups account for a total of 49.1% of the species composition of the native flora of the MSNR. Among them, a low proportion of therophytes (75 species, 10.8%) is observed. The proportion of therophytes is high in the alien flora (72 species, 41.0 %) (Figure 5). Hemicryptophytes are in second place (48 species, 27.6%). The other groups account for 54 species (31.4%) of the alien flora of the MSNR. It should be noted that the alien flora includes a significant proportion of woody species – phanerophytes (22 species, 12.6%) and nanophanerophytes (24 species, 13.8%). Combined, these represent 46 species, 26.4%. There are 20 species of phanerophytes (2.9%) and 30 species of nanophanerophytes (4.3%) in the native flora, which are characteristic of the entire territory of the central zone of the European part of Russia (Maevskiy, 2014). During the study, we identified the chorological structure of the MSNR flora. We distributed the species of the native flora fraction by longitude and latitude range groups (Table 5).

Table 5. Longitudinal groups of ranges of the native flora of the Mordovia State Nature Reserve

Longitudinal groups of ranges	Number of species	
	Absolute	% of native flora
Euro-Asian	168	24.2
Euro-Asian-North American	142	20.4
Euro-Siberian	80	11.5
European	75	10.8
European-West Siberian	70	10.1
Pluriregional	31	4.5
Euro-Ancient Mediterranean	29	4.1
Euro-Siberian-North American	23	3.3
European-West Siberian-Ancient Mediterranean	20	2.9
Euro-Siberian-Ancient Mediterranean	11	1.6
European-North American	10	1.4
Holarctic	7	1.0
East European-West Siberian	7	1.0
East European-Siberian	5	0.7
East European	5	0.7
European-West Siberian-North American	5	0.7
East European-Asian	3	0.4
East European-Ancient Mediterranean	3	0.4
European-Ancient Mediterranean-North American	1	0.1
Total	695	100,0

The composition of the native flora of the MSNR is dominated by species of the Euro-Asian (168 species, 24.2%) and Euro-Asian-North American (142 species, 20.4%) range groups. The other wide-area groups, Euro-Siberian (80 species, 11.5%), European (75 species, 10.8%), and, European-West Siberian (70 species, 10.1%) contain somewhat fewer species. The other groups contain fewer species. The predominance of species with wide ranges is characteristic for the floras of many regions of Central Russia (Kazakova, 2004; Silaeva et al., 2010; Gafurova, 2014; Vasyukov et al., 2020; Reshetnikova et al., 2010). The spectrum of latitude groups of flora species ranges of the MSNR is presented in Table 6.

Table 6. Latitudinal groups of ranges of the native flora of the Mordovia State Nature Reserve

Latitudinal groups of ranges	Number of species	
	Absolute	% of native flora
Plurizonal	284	40.9
Boreal-nemoral	129	18.6
Boreal	122	17.6
Forest-steppe	74	10.6
Nemoral	54	7.8
Steppe	21	3.0
Hypoarctoboreal	10	1.4
Taiga	1	0.1
Total	695	100.0

The spectrum of latitude groups of flora ranges of the MSNR indicates the predominance of plurizonal species confined to several natural zones (40.9% of species). It is notable that species of forest natural zones, including boreal-nemoral (18.6 %), boreal (17.6 %), and forest-steppe (10.6 %) species, also play a significant role in the flora of the MSNR. The other groups have much fewer species. This suggests that the reserve's territory is situated within the natural zone of mixed (coniferous-deciduous) forests. We analyzed the composition of the florogenetic groups of the alien flora of the MSNR (Esina et al., 2022). The highest proportion of alien flora species of the MSNR comes from the Mediterranean (22.4%), North America (21.8%), and the Iranian-Turkish region (16.7%). The other groups account for 39.1% of the species (Esina et al., 2022). The alien flora species of the MSNR are currently classified into 13 florogenetic groups.

We also classified the native flora species of the MSNR into ecological-cenotic groups according to their characteristic ecotopes. Based on our own observations and literature data, we distinguished ecological-cenotic groups of flora species of the MSNR (Kuznetsov, 1960; Borodina et al., 1987; Silaeva et al., 2010; Vargot et al., 2016). Table 7 shows the species distribution of the native flora fraction

of the MSNR by ecological-cenotic groups.

Table 7. Ecological-cenotic groups of the native flora of the Mordovia State Nature Reserve

Ecological-cenotic group	Number of species	% of native flora
Forest	167	24.0
Broad-leaved forest	51	7.3
Forest	52	7.5
Coniferous-forest	38	5.5
Coniferous-forest	23	3.3
Mountain-forest	2	0.3
Psammophilous coniferous-forest	1	0.1
Swamp	140	20.1
Meadow-swamp	50	7.2
Forest-swamp	46	6.6
Aquatic-swamp	28	4
Oligotrophic bog	16	2.3
Meadow	121	17.4
Meadow	51	7.3
Meadow-steppe	35	5.0
Meadow-edge	21	3.0
Floodplain-meadow	14	2.0
Weed	112	16.2
Weed	49	7.1
Weed of meadow	48	6.9
Weed of steppe	8	1.2
Weed of forest	7	1
Aquatic	77	11.1
Aquatic	38	5.5
Coastal	32	4.6
Coastal-alluvial	7	1
Forest-Meadow	73	10.5
Steppe	5	0.7
Steppe	3	0.4
Calcefit-Steppe	1	0.1
Psamophyte-Steppe	1	0.1
Total	695	100

The spectrum of large ecological-cenotic groups of plants found in the flora of the MSNR exhibits a nearly equal ratio of species belonging to forest, swamp, meadow, weed, and aquatic groups. The

position of the MSNR on the border of natural zones of mixed forests and forest-steppe, diversity of forest species, microrelief, soil conditions, and hydrographic network of the protected area provides a high diversity of biotopes, which in turn gives rise to a large number (25) of specific ecological-genetic subgroups. Furthermore, the flora is notable for its high prevalence of weed species, which can be attributed to the presence of Pushta settlement, cordons, a well-developed network of forest clearings and roads, and mineral strips in the MSNR forest area. The presence of weed-meadow species was identified in the Moksha and Satis rivers' floodplains, where soil erosion occurs during floods.

Discussion

When studying the flora of any territory, there is always a question about the degree of its study. This question cannot be answered objectively without analyzing detailed floristic lists from different years. The dynamics of identification of taxonomic units of the MSNR flora is illustrated in Table 1, Figures 2 and 3. The form of the graphs in Figure 2 shows that most of the species, genera, and families of the native flora have been identified. Based on the graphs in Figure 2 and the fact that the MSNR has employed qualified florists for 87 years, we accept that 695 species represent 99% of the native flora. We can now conclude that only 74.8% (1936-1940) of the MSNR native flora could be identified in the first three years of the flora inventory. During almost twenty years of total survey of the MSNR area (1966-1987), the degree of study of the native flora of the MSNR increased to 92.8%. Initially, the network of routes followed the minor rides throughout the reserve (Kuznetsov, 1960), but later botanists studied various biotopes, including those that were difficult to access (Borodina et al., 1987). 98.1% have been identified for 2016, and approximately 99% of vascular plant species have been identified for 2023. Of course, we do not exclude the possibility of finding new local species in the future, as the flora is an open biological system.

We cannot determine to what extent the alien flora has been studied. As Figure 3 illustrates, the graphs tend to increase, i.e., there is a constant invasion of new alien taxonomic units into the MSNR territory. This is due to the fact that in the Pushta settlement, in addition to vegetables, the residents grow various fruits and berries, and ornamental plants. Birds facilitate the dispersal of edible fruits, while ornamental plants are dispersed primarily by seeds, which germinate well on the disturbed sands found in the settlement. Moreover, in 1936 a nursery of trees from various biogeographical areas was organized in the MSNR forest (Esina, 2023). We assume that the process of species naturalization around the nursery began after 2006, as there was no evidence of species wilding from the nursery prior to that time (Kuznetsov, 1960; Borodina et al., 1987; Tereshkina, 2000, 2006). Thus, the nursery became a source of alien species new to the flora of the Republic of Mordovia (*Berberis thunbergii* DC., *Crataegus maximowiczii* C.K. Schneid., *Prunus serotina* Ehrh.,

etc.) and European Russia (*Menispermum dauricum* DC., *Vitis amurensis* Rupr., *Syringa josikaea* Jacq. ex Reichb., etc.) (Esina et al., 2021a,b; Verchozina et al., 2024).

The spectrum of families of the native flora of the MSNR has changed little over time. It is dominated by the same families as in the flora of Mordovia (Silaeva et al., 2010). It differs from that of the Republic of Mordovia by its location in the second position of the family Cyperaceae. This is due to the occurrence of boreal sedges (*Carex chordorrhiza* L.f., *C. disperma* Dewey, *C. loliacea* L., *C. magellanica* subsp. *irrigua* (Wahlenb.) Hiitonen, *C. utriculata* Boott) in the MSNR, which are at the southern limit of their range (Silaeva et al., 2010; Vargot et al., 2016). After the first inventory, the number of families in the flora does not add up to much. There is mainly an increase in the number of identified genera in already known families and species within identified genera. In the spectrum of families of alien flora there are constant changes, new genera from different families, species within genera are added.

The peculiarities of the systematic, biotypes, chorological and ecological-cenotic structure of the native flora of the MSNR revealed by us confirm the fact that the forest area of the MSNR should be considered as a southern extension of the natural zone of mixed (coniferous and broadleaved) forests (Figure 1) (Mil'kov, 1953). This botanical-geographical location of the MSNR has resulted in the presence of numerous boreal, boreal-nemoral and hypo-arctoboreal species at the southern limit of their range in the flora. Among them are species known in Mordovia in the only MSNR localities (Silaeva et al., 2010): *Alnus incana* (L.) Moench, *Hieracium arcuatidens* (Zahn ex Petunn.) Juxsip ex Schljak., *Galium triflorum* Michx., *Pedicularis dasystachys* Schrenk, *Glyceria lithuanica* (Gorski) Gorski, *Holcus mollis* L., *Avenella flexuosa* (L.) Drejer, *Listera cordata* (L.) R. Br., and also known from single localities in the MSNR and Mordovia, listed in the Red Data Book of the Republic of Mordovia (2017) (*Huperzia selago* Bernh. ex Schrank et Mart., *Lycopodiella inundata* (L.) Holub, *Botrychium virginianum* (L.) Sw., *Lunaria rediviva* L., *Moneses uniflora* (L.) A. Gray, *Pyrola media* Sw., *Salix lapponum* L., *Salix myrtilloides* L., *Pedicularis palustris* L., *Viola uliginosa* Bess., the aforementioned members of the genus *Carex*, *Eriophorum latifolium* Hoppe, *Cinna latifolia* (Trev.) Griseb., *Iris sibirica* L., *Corallorhiza trifida* Chatel., *Dactylorhiza maculata* (L.) Soo, *Goodyera repens* (L.) R. Br., *Gymnadenia conopsea* (L.) R. Br., *Malaxis monophyllos* (L.) Sw., *Potamogeton alpinus* Balb.) and the Red Data Book of Russia (List..., 2023) (*Cephalanthera rubra* (L.) Rich. (2), *Cypripedium calceolus* L. (2), *Hemipilia cucullata* (L.) Y.Tang, H.Peng & T.Yukawa). All of them are listed in the Red Book of the Republic of Mordovia (Red Data Book..., 2017).

Conclusions

Based on the above data, we conclude that the composition of the native flora of the MSNR is more than 99% identified. In the first years of the flora inventory, about 70% of the native flora is identified. The floristic data analysis revealed that the natural flora exhibited characteristics of a forest, despite the presence of a forest-steppe zone adjacent to the southern border of the MSNR. The primary indicators of systematic structure, composition of life forms, and ranges of species of native flora collectively indicate that the MSNR forest area is situated within the natural zone of mixed (coniferous-broadleaved) forests. A comparison of long-term data from the MSNR flora study revealed that the formation process of the alien flora of the MSNR, its structure, and chronological groups had not been completed yet. It will continue until the cultivation of plants from different continents and natural areas in protected areas is banned.

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