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Articles

Ecological conditions and biodiversity of meadow vegetation of the Crillon Peninsula (Sakhalin Island)

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The Crillon Peninsula is located in the southwest part of Sakhalin Island and is a poorly explored territory. Despite the small size of the peninsula, environmental conditions in different parts of Crillon may vary. The research materials include 58 relevés from the northwest and southeast subregions of the peninsula. Taxonomic analysis was performed; and ecological patterns of meadow vegetation using the indicator scales of DN Tsyganov and IA Tsatsenkin were identified. Indices of species diversity, dominance, evenness, and the Jaccard index of similarity were calculated. The classification was based on a resemblance matrix of relevés calculated with the quantitative Bray–Curtis index. A total of 121 plant species representing 93 genera and 27 families have been found in the meadow ecosystems on the Crillon Peninsula. Five groups of meadow phytocoenoses were distinguished after classification, and nearly all of them are distributed equally in both research locations. The Crillon Peninsula's north-west subregion has higher species diversity and equitability indices, whereas the southeast subregion has higher dominance indices. According to the results of the indicator analysis, both subregions of the Crillon Peninsula have the identical climatic and edaphic conditions. Statistically significant differences were obtained only for the regimes of climate continentality, harshness of winter, soil nitrogen richness (at $p < 0.01$) according to DN Tsyganov's scales, and for indicators of soil richness/salinity and pasture digression (at $p < 0.05$) according to the scales of IA Tsatsenkin. These differences are explained by the climatic characteristics of the peninsular coasts and human activities. The results obtained allow us to conclude that data from one study location can be carefully extrapolated to the entire Crillon Peninsula. During the extrapolation process the anthropogenic stress and agricultural development should be considered.

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Keywords

Classification, comparison, grass, indicator analysis

Introduction

The Crillon Peninsula is located in the southwest of Sakhalin Island. Due to the condition's heterogeneity, this unique territory contains a wide variety of land-scapes and species of fauna and flora. According to the botanical-geographical zoning of Sakhalin, the Crillon Peninsula is separated into a detached (Crillon) region (Krestov et al. 2004). A.I. Tolmachev (1955) classified this territory as a subzone of dark coniferous forests with an admixture of large-leaved species. The floristic isolation of this area is characterized by the presence of species common to the southern Kuril Islands and Hokkaido Island. Some of them are common to the flora of Moneron Island (Krestov et al. 2004). The Crillon Peninsula is naturally divided into two parts by the Yuzhno-Kamyshovyy Ridge, and the resulting subregions are influenced by different sea currents and, often, different weather and climate phenomena (Zemtsova 1968; Bratkov et al. 2021). Given this, it becomes unclear if the data collected for any one area of the peninsula can be extrapolated.

Forested areas predominate throughout the Sakhalin Island, including the Crillon Peninsula. Before there was any significant human settlement, forest covered the island almost entirely. The forest vegetation of Sakhalin is well studied from different points of view (Korznikov et al. 2019; Verkhoturov and Melkiy, 2020; Korznikov et al. 2020; Sabirova and Sabirov 2022; Talskih et al. 2022; Korznikov et al. 2022; Melkiy and Verkhoturov 2023; Lozhnikova et al. 2023; Popova and Denisova 2024).

The Sakhalin meadows do not form significant areas and are in a subordinate position (Stepanova 1961). In the middle of the 20th century, extensive research on meadow phytocoenoses was conducted (Tolmachev 1955; Stepanova 1961). Nowadays, the meadow communities of Sakhalin are being actively studied (Rozhkova-Timina et al. 2023; Rozhkova-Timina 2023; Rozhkova-Timina et al. 2024), but there are still many unanswered questions. At the same time, understanding the biological diversity and ecological structure of meadows appears to be essential to understanding Sakhalin Island's ecology. Previously, we published a paper on the ecological assessment of meadow phytocoenoses in the southern part of Sakhalin (Rozhkova-Timina et al. 2024), but those studies covered only a small part of the Crillon Peninsula. Knowing that the Crillon Peninsula has been classified as a separate botanical and geographical region (Krestov et al. 2004), further in-depth study of this area is required.

Firstly, it is necessary to clarify what is meant by "meadow." The literature has various definitions for this term. "Haymaking" and "meadow" are synonymous terms in the agriculture industry. A.P. Shennikov (1941) defined a meadow as a form of biogeocoenosis whereby the vegetation is represented by associations of perennial herbaceous mesophytes. According to L.G. Ramensky (1938), meadows are areas with high, but not excessive, and relatively ensured moisture, without noticeable summer drought, and soils that are neither very acidic nor rarely alkaline or saline. These areas typically support grass stands made up primarily of perennial mesophilic grasses that grow all summer long without experiencing a significant summer depression. A more comprehensive definition of meadows was provided by T.A. Rabotnov (1974): meadows can be understood as biogeocoenoses, where the vegetation is represented by herbaceous communities with a more or less closed herbage formed mainly by perennial mesophilic (i.e., plants of average water supply) and occasionally hygrophilious grasses that have a winter break (or a sharp decrease) in the growing season, growing normally without summer depression, and with soils that vary in terms of moisture levels (from dry to wet), moisture variability, richness, and levels of readily soluble salts (from fresh to moderately saline). Meadows are defined as lands covered by perennial herbaceous plants in our work (Dmitriev 1948).

The hypothesis being tested is that the data obtained on the meadow vegetation of the Crillon Peninsula cannot be extrapolated due to the difference in natural conditions. Aim: assessment of meadow vegetation's phytodiversity and ecological conditions in the northwest and southeast Crillon Peninsula subregions.

Tasks:

1. Characterize the taxonomic structure of meadow vegetation on the Crillon Peninsula, emphasizing subregional differentiation.;
2. Determine and compare biodiversity indices for each subregion;
3. Examine the variations in the floristic composition of the two subregions;
4. Use indicator analysis to evaluate the ecological conditions of the Crillon Peninsula's various subregions.

Materials and methods

Study site

The area of the Sakhalin Oblast (Sakhalin Island and the Kuril Islands) is 87.1 thousand km^2; the area of Sakhalin is 76 thousand km^2. The climate of Sakhalin has a pronounced monsoon character. The topography is one of the factors determining the average air temperature in different sections of the island. Winter is defined by a persistent, stable layer of snow (60–100 cm). The long, cold spring lasts until June, when snowfall occurs. Significant cloud cover and recurrent fogs are characteristics of summer (Zemtsova 1968).

The Crillon Peninsula is located in the southwest part of Sakhalin (Fig. 1). It is about 100 km long, and its maximum width is 50 km. The central part of the peninsula has a mountainous relief (Yuzhno-Kamyshovyy Ridge), which is covered with forests. On the east side, the Crillon Peninsula is washed by Aniva Bay (the Sea of Okhotsk), and on the west side by the Strait of Tartary (the Sea of Japan). Meadow vegetation is mostly developed on the seacoast, with occasional patches in the valleys between hills. The distance between the two study areas in a straight line is 60 km. However, despite the short distance, environmental conditions may vary. For example, the west coast's climate is affected by the Soya branch of the warm Tsushima Current. According to the "Weather and Climate" online resource, the average annual temperature from 1971 to 2023 for the coast of Crillon in the northwest part (the nearest weather station is Nevelsk) is +4.9 °C, and for the southeast part (the nearest weather station is Cape Crillon) is +4.3 °C. More detailed data on the Crillon climate is presented in Table 1: it is evident that some parameters such as average annual temperature, humidity, average annual maximum of snow cover, Kira's warmth index differ significantly. Wind activity is influenced by the Yuzhno-Kamyshovyy Ridge. As a result, wind conditions may differ in geographically close areas (Zemtsova 1968; Bratkov 2021). There is statistical data on the freezing of the seas around Crillon (Romanyuk et al., 2017; PLANETA, Hydrometcenter of Russia, Roshydromet): the Strait of Tartary retains ice-free water throughout the winter almost every year; Aniva Bay freezes throughout the winter, with formation of the thickest ice (up to 30 cm.) in February.

Parameter	Nevelsk town (NW subregion)	Cape Crillon (SE subregion)
Average annual temperature, °C (1971–2023)	4.9±1.1	4.3±0.8
Average temperature of January, °C (2012–2024)	-6.6	-5.9
Average temperature of July, °C (2012–2024)	+17.3	+14.3
Humidity, % (1971–2023)	75.8±2.5	87.5±3.2

Amount of precipitations, mm/month (1971–2023)	885.8±192.9	879.8±225.5
Kira's warmth index	45.2	34.6
Average annual maximum of snow cover (1971–2023)	71.6±46.0	38.2±39.4
Average amount of snow days per year (1971–2023)	140.2	125.8

Table 1. *Climatic conditions of the Crillon Peninsula (according to "Weather and climate", "Weather archive", Krestov et al. 2004)*

Methodology

The research was based on 58 authors' relevés (20 in the northwestern part and 38 in the southeastern part). The studies were carried out using the route method (length of the route was 30 km) with the determination of the species composition of the meadow; the dominant species were identified with an evaluation of their percentage. The collection of field materials was based on general methodological guidelines (Field Geobotany, 1959–1972). Field work was carried out in the northwestern (NW) part of the Crillon Peninsula (near the town of Nevelsk, the villages of Gornozavodsk and Shebunino) and in the southeastern (SE) part (near the mouths of the rivers Naichi, Riflyanka, and Moguchi, not far from Cape Anastasia). The great difference between these two parts is that the northwestern subregion is much more agriculturally developed than the southeastern one.

The system of scientific names for vascular plant species is based on the check-list of SK Cherepanov (1995), with later additions from monographic sources. Processing of relevés was carried out using the IBIS v.7.2 software (Zverev 2020), PAST v.4.17 and Statsoft Statistica 12.

Due to the fact that the number of relevés in two subregions varies greatly, the number of species was normalized to a single relevé using the Chao 1 index (Chao 1984). Index Chao 1 means the assessment of the completeness of the species list by the weight of the characteristic: abundance, occurrence, etc. in absolute units. We did in PAST the assessment of the absolute number of species encounters in the flora.

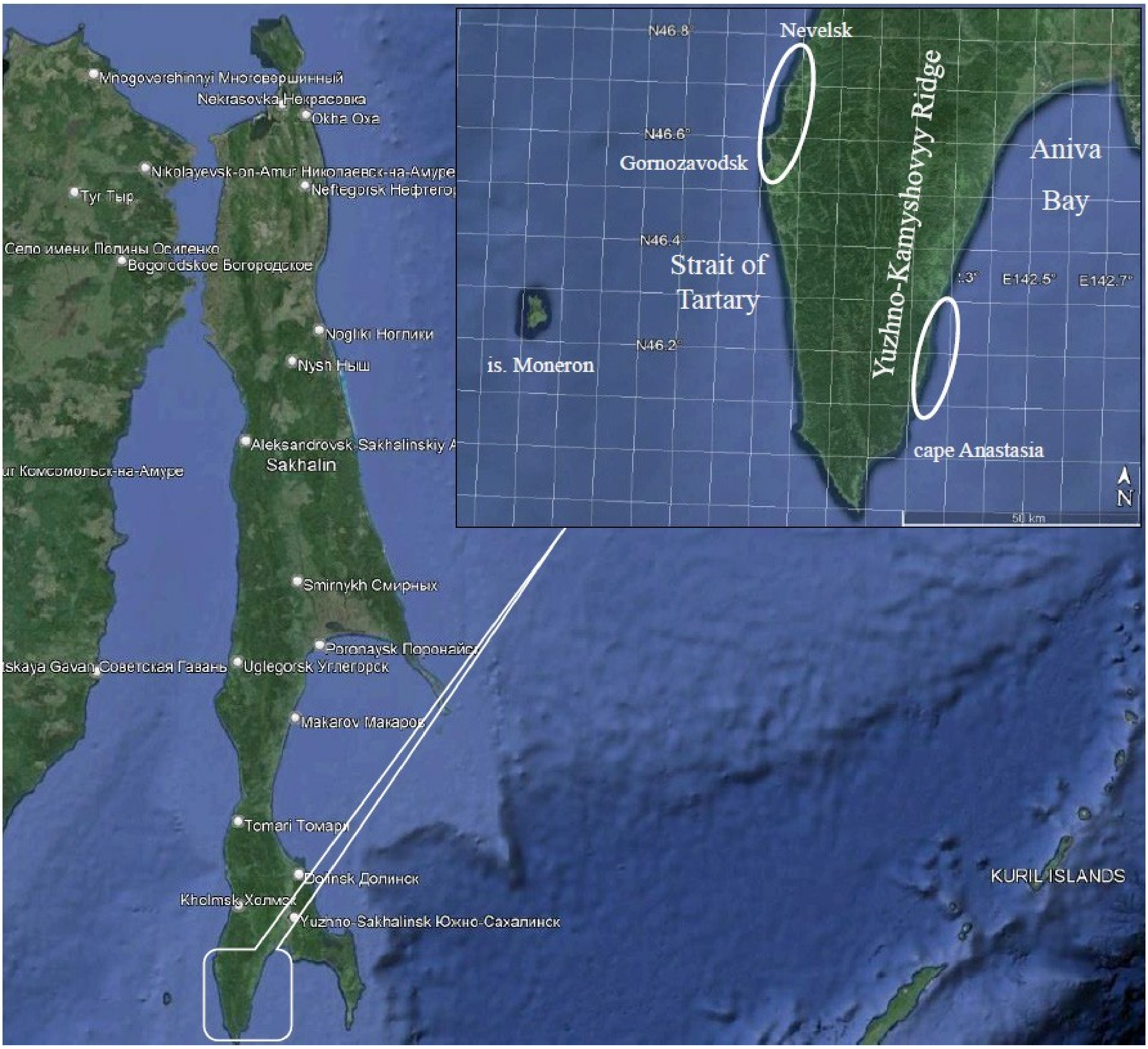


Figure 1. *Location of the Crillon Peninsula on Sakhalin Island. The inset indicates the study areas. Map data 2024 (c) Google.*

For estimation of the difference significance were used the nonparametric Mann–Whitney test (Mann and Whitney 1947). We have performed a normality test for the diversity indices: the distribution was statistically significantly different from normal (Shapiro-Wilk's test, Shapiro-Wilk test for normality or Shapiro-Wilk's W test (Shapiro et al. 1968) $p<0.01$).

The quantitative parameters of the meadow vegetation of the Crillon Peninsula were calculated for taxonomic analysis. They include the total number of families, genera, and species; the average number of species in a family or genus; the proportion of single-species genera and families; the ten leading families by species richness and by the share of occurrence (the relative number of relevés where the species appears). There were calculated species diversity index of Margalef (log2) (1958); dominance index of Berger-Parker (1970); equitability index of Pielou (1966); and Jaccard's species composition similarity index (1900). A resemblance matrix of the relevés was calculated using the Bray-Curtis quantitative index (Bray and Curtis 1957) for cluster analysis, and a dendrogram was constructed. WPGMA linking method (Sokal, Michener 1958) was used for hierarchical cluster analysis and served as the basis for the classification of meadow vegetation. Ecological patterns of meadow vegetation growth were identified using the indicator scales of DN Tsyganov (1983) and IA Tsatsenkin et al. (1978). The calculation of average ecological status was carried out using a double-weighted average (Zverev 2020) in the IBIS software.

Results and discussion

Taxonomic Structure

Taxonomic analysis is a crucial component of biodiversity research, as it identifies the quantitative characteristics of meadows. The ratio of the number of genera and species in a flora is an important taxonomic characteristic. According to A.I. Tolmachev (1974), autochthonous development leads to a relative enrichment of the flora in species, whereas allochthonous development results in a relative enrichment in genera.

In total, in the meadow communities of the Crillon Peninsula, there were 121 plant species registered (including plants of shrub and tree forms), which belong to 93 genera from 27 families. The important point is that 20 relevés of the north-western subregion include 92 unique species, and 38 relevés of the southeastern subregion – 70 species. This is linked with higher anthropogenic impact at the north of the Crillon Peninsula: there are more adventive species; moreover, many fodder grasses are seeded on agricultural meadows every year. After normalization, the Chao 1 index (expected number of species) was 144 and 82.63 for NW and SE, respectively.

The richest in species were the families Asteraceae (30 species), Poaceae (19 species), Fabaceae (10 species), Rosaceae (9 species), and Apiaceae (7 species). In terms of occurrence frequency, the leading families include Poaceae (share of occurrence: 27.01%), Asteraceae (share of occurrence: 24.68%), Apiaceae (share of occurrence: 9.69%), Fabaceae (share of occurrence: 8.63%), and Rosaceae (share of occurrence: 6.46%). This parameter was calculated in the relative family-species spectrum by weighing the representation of families by the percentage occurrence of their species. Because there are more relevés where species of the family Apiaceae are documented, the family Apiaceae, which is smaller than the families Fabaceae and Rosaceae in terms of species, rises in rank. Other proportion patterns of the five leading families are seen in different Crillon subregions (Fig. 2). In the north-west subregion, the richest in species are the families Asteraceae, Poaceae, Fabaceae, Rosaceae, and Apiaceae; and in the southeast Poaceae, Asteraceae, Rosaceae, Apiaceae, and then Fabaceae, Polygonaceae, Lamiaceae, and Scrophulariaceae with the same number of species. In terms of occurrence frequency, the five leading families in the northwest subregion are represented by Poaceae, Asteraceae, Fabaceae, Rosaceae, and Apiaceae, and in the southeast subregion Asteraceae, Poaceae, Apiaceae, Fabaceae, and Polygonaceae.

Classification and Biodiversity of Meadow Communities

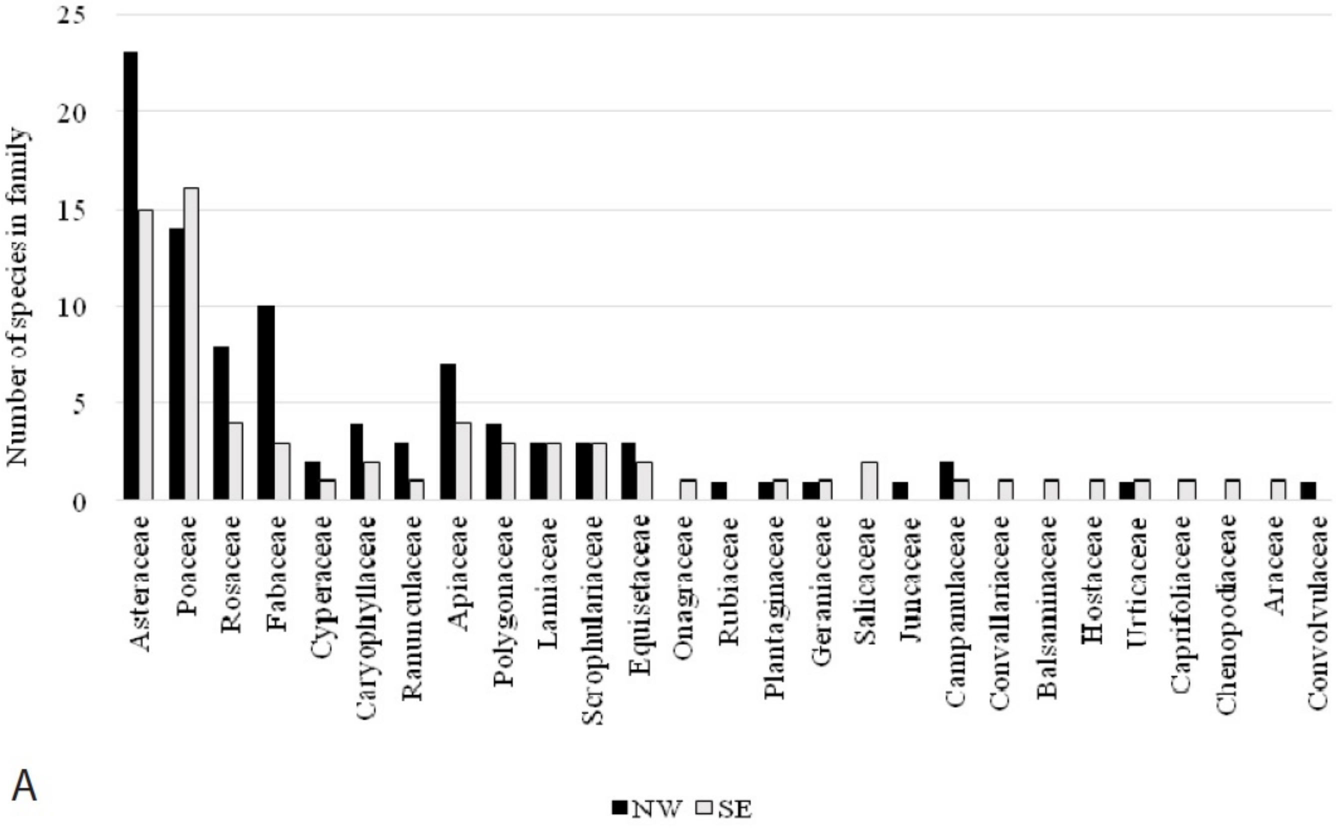
The species diversity of meadow vegetation is more pronounced in the biocoenoses of the northwest subregion of the Crillon Peninsula (Table 2). They are more equitable as well.

Diversity indices depend on the volume of units distributed over the senior category (in our case, this is the distribution of the sums of occurrences by taxa in the summary lists of subregion). So, there is a natural difference between the overall index and the indices of species diversity and dominance for the individual portions (subregions). Nevertheless, Table 2 also provides indices for the entire peninsula for informational purposes. The table also displays the Jaccard index.

In terms of phytodiversity, the southeast subregion has stronger dominance indices, whereas the northwest subregion has higher species diversity and equitability indices. Because of the high anthropogenic impact, the phytodiversity at the north-west subregion is higher.

Differences in α-diversity metrics between the two peninsula subregions were evaluated. Further use of parametric linear correlation analysis was possible due to the confirmation of the statistical significance's compliance with the normal law for the partial samples employed in the analysis at a significance level of $p < 0.05$. The t-Student test revealed no statistically significant differences (at a significance level of $p < 0.05$) for any parameter between the peninsula's northwest and southeast subregions. The result of the nonparametric Mann–Whitney test was the same.

After a resemblance matrix was calculated using the Bray–Curtis quantitative index, the results of hierarchical cluster analysis (WPGMA linking method) served as the basis for the classification of meadow vegetation (Fig. 3).



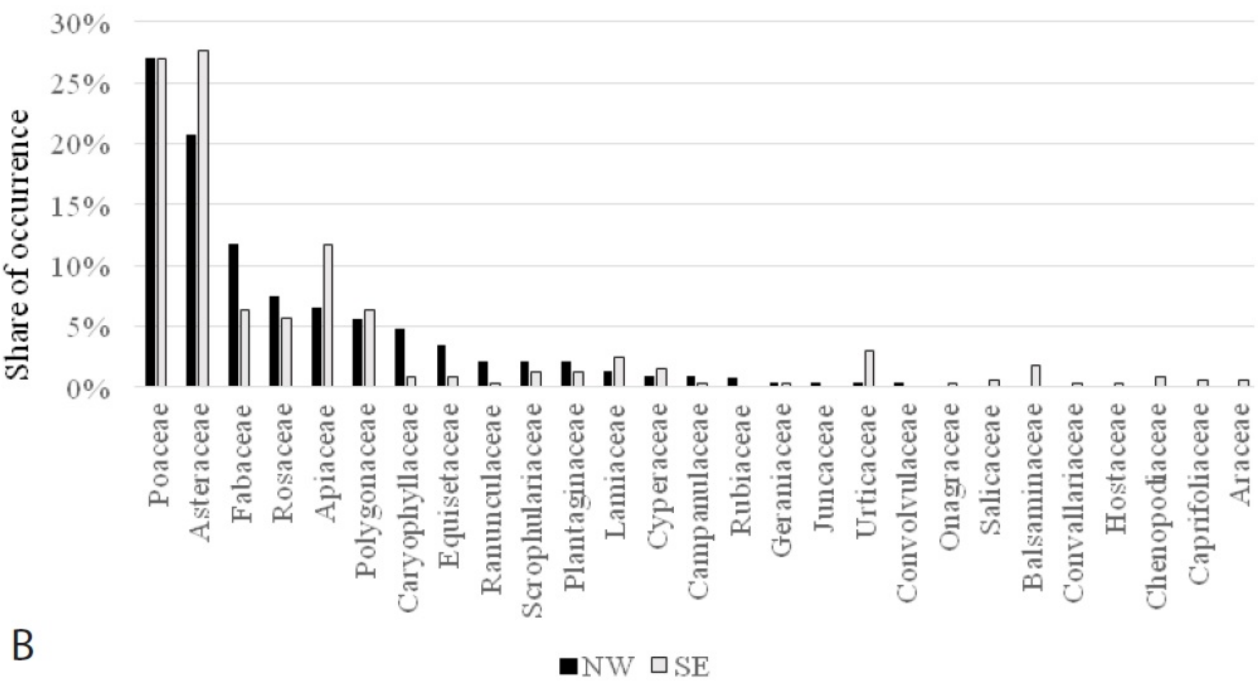


Figure 2. *Family-species spectra of the northwest and southeast regions of the Crillon Peninsula.* ***A*** *– by the number of species. For each family, the number of species belonging to it is given.* ***B*** *– weighted by percentage occurrence. For each family, the proportion of its occurrence is given.*

Object		NW	SE	Total
Indices of species	Margalef (log2) H	9.0076	7.0596	12.1425

diversity	Menhinick H	2.7745	2.3658	3.9382
Indices of dominance	Berger-Parker D	0.0564	0.0754	0.0662
	Simpson D	0.0208	0.0278	0.0207
Indices of equitability	McIntosh E	0.9556	0.9465	0.9418
	Pielou J	0.9258	0.9073	0.8888
Average index of similarity of species composition	Jaccard	0.1212±0.0088	0.1370±0.0052	0.1133±0.0029
Index of similarity of species composition	Jaccard	0.3333		–

Table 2. *Diversity indices at the species level in the studied biocoenoses*

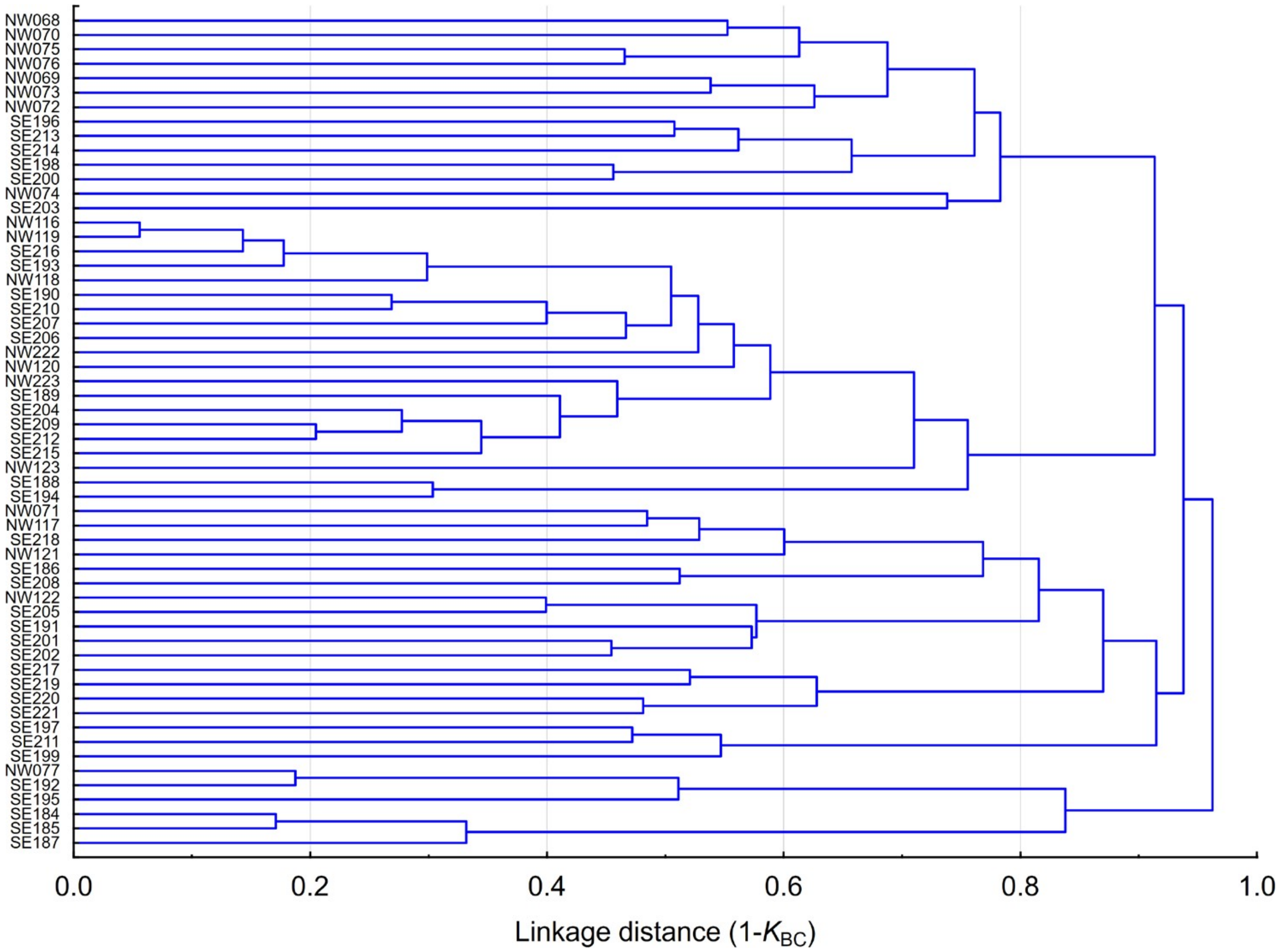


Figure 3. *Dendrogram of resemblance of 58 relevés of meadow vegetation, similarity coefficient – Bray-Curtis index, linking method – WPGMA. NW – relevés of the northwest part of the Crillon Peninsula, SE – relevés of the southeast part of the Crillon Peninsula.*

Several syntaxa have been identified:

1. Grass–forb communities. The group includes 14 relevés (from NW068 to SE203 on Fig. 2). The dominant species equally include *Dactylis glomerata* L., *Phalaroides arundinacea* (L.) Rauschert, *Festuca pratensis* Huds., *Trifolium pratense* L., *Poa pratensis* L., *Poa palustris* L., *Phleum pratense* L., *Amoria repens* (L.) C. Presl., *Agrostis tenuis* Sibth., *Artemisia vulgaris* L., *Equisetum arvense* L., *Sanguisorba tenuifolia* Fisch. ex Link, *Galium verum* L. The height of the grass stand

varies from 30 cm to 170 cm. The projective cover averages 90%. This group of grasslands is equally distributed in both subregions of the Crillon Peninsula.

2. *Leymus mollis* communities. The group covers 20 relevés (from NW116 to SE194 on Fig. 2). These communities are located directly on the sandy soils of the seacoast. The dominant species is *Leymus mollis* (Trin.) Pilg., less common are *Lathyrus japonicus* Willd., *Artemisia vulgaris*, *Artemisia littoricola* Kitam., and *Calamagrostis langsdorffii* (Link.) Trin. The average height of the grass stand is 120 cm, while the shoots of *Leymus mollis* reach 160 cm. The average projective cover of such meadows is 60%. This group of meadows is equally distributed in both subregions of the Crillon Peninsula. *Leymus mollis* communities are often classified not as meadows but as dune vegetation (Mucina et al. 2016); however, they fully correspond to the definitions we gave in the introduction and can be classified as meadow areas (Stepanova 1961; Neshataeva 2009).

3. Tall-grass communities. The group includes 18 relevés (from NW071 to SE199 on Fig. 2). The dominant species include *Angelica ursina* (Rupr.) Maxim., *Reynoutria sachalinensis* (Fr. Schmidt) Nakai., *Petasites amplus* Kitam., *Filipendula camtschatica* (Pall.) Maxim., *Senecio cannabifolius* Less., *Cirsium kamtschaticum* Ledeb. ex DC., and *Cacalia robusta* Tolm. The average height of the upper sublayer of the herbage is 250 cm; shoots of *Angelica ursina* often reach a height of 400 cm. The lower sublayer is represented by *Anthriscus sylvestris* (L.) Hoffm., *Sasa kurilensis* (Rupr.) Makino & Shibata, *Calamagrostis langsdorffii*, *Equisetum arvense*, *Urtica dioica* L., *Rumex obtusifolius* L., and *Impatiens nolitangere* L.; the average height of this sublayer is 130 cm. The projective cover is 80–90%. These species prefer well-moistened habitats and are often found in floodplains. This group of meadows is equally distributed in both subregions of the Crillon Peninsula. Tall-grass communities are usually classified as a special type of vegetation (Morozov and Belaya 1988), but they also correspond to the definition of meadows.

4. *Phragmites australis* communities (from NW077 to SE195 on Fig. 2). The dominant species is *Phragmites australis* (Cav.) Trin. ex Steud.; also found are *Senecio cannabifolius*, *Aster glehnii* Fr. Schmidt, and *Artemisia vulgaris*. The average height of the grass stand is 200 cm, and the projective cover is 100%. This group of meadows is distributed in both subregions of the Crillon Peninsula.

5. *Sasa kurilensis* communities (from SE184 to SE187 on Fig. 2). We recorded these phytocoenoses only in the southeast subregion of the Crillon Peninsula. The dominant species is *Sasa kurilensis*, and *Calamagrostis langsdorffii* is also common. The average height of the grass stand is 150 cm, and the projective cover is 90%.

It is evident that practically every group of herbal plants that have been recognized is spread evenly throughout the Crillon Peninsula. Thus, the identification of syntaxa from the dominant classification demonstrated the absence of geographic differences in meadow vegetation.

Indicator analysis

Indicator analysis was used to evaluate the degree of pasture digression and the climatic and edaphic conditions using the scales developed by DN Tsyganov (1983) and IA Tsatsenkin et al. (1978). The following DN Tsyganov's scales were used in the calculations: climate continentality (Kn), ombroclimatic scale of aridity-humidity (Om), winter harshness (Cr), soil moisture (Hd), soil salt regime (Tr), soil acidity (Rc), soil nitrogen richness (Nt), and soil moisture variability (fH). Using IA Tsatsenkin's scales, we assessed soil moisture (M), soil richness and salinity (RS), and the degree of pasture digression (PD). The nonparametric Mann-Whitney test was used to compare the obtained average scores.

The continentality of the climate regime, the degree of winter harshness, and the richness of soils in nitrogen showed statistically significant variations ($p < 0.01$). Table 3 shows that there are statistically significant differences between the pasture digression and soil richness/salinity indices at $p < 0.05$. It is clear that most of the climatic and edaphic habitat regimes are common to both study areas.

	Mean ± st. dev. NW	Mean ± st. dev. SE	U	p	Prevailing habitat regime
Regimes of DN Tsyganov's scales. p < 0.01					
Tm	7.74±0.68	7.22±1.04	280.0	0.079131	Subboreal
Kn	8.98±0.39	8.32±0.80	168.0	0.000358	Intermediate between continental and subcontinental
Om	8.22±0.77	8.61±0.89	286.0	0.097144	Intermediate between subarid and subhumid
Cr	6.93±0.67	7.46±0.47	189.0	0.001244	Intermediate between quite harsh winters and moderate winters (NW); moderate winters (SE)
Hd	12.19±0.70	12.56±0.84	270.0	0.056234	Intermediate between dry meadow and wet meadow
Tr	7.20±1.11	6.58±1.30	279.5	0.077800	Quite rich soils; intermediate between of not rich and quite rich
Rc	6.60±0.63	6.54±0.55	330.0	0.856315	Intermediate between acidic and slightly acidic soils
Nt	7.16±1.01	7.93±0.65	174.0	0.002925	Sufficiently nitrogen-supplied soils
fH	6.23±0.54	6.39±0.30	242.0	0.140475	Intermediate between weakly variable and moderately variable soil moisture
Regimes of IA Tsatsenkin et al. scales. p < 0.05					
M	66.76±2.03	67.10±2.36	321.0	0.216894	Wet meadow
RS	10.51±0.50	10.16±0.42	247.0	0.016112	Quite rich soils
PD	2.84±0.28	2.66±0.27	241.0	0.012638	Weak effect of grazing

Table 3. *Indicators of habitat regimes and statistical significance of differences (parameters, which difference is statistically significant, are highlighted in bold)*

According to the climate scales of D.N. Tsyganov (1983), the climate of the study areas is predominantly subboreal, closer to subhumid, with a soil moisture regime close to wet meadow. These territories occupy vast, relatively well-drained spaces on gentle slopes, sea terraces, and floodplains. The soils are close to slightly acidic, with slightly to moderately variable moisture. They are both well supplied with salts (glycopermesotrophs and glycosemieutrophs) and quite rich in nutrients. This regime is caused by the location: river floodplains, lower parts of slopes, and seacoasts. At the same time, statistically significant differences are shown in the regimes of soil nitrogen richness, climate continentality, and the harshness of the winter period. The latter is quite explainable by climatic nuances: in Section 2 ("Study site") we provided data on the temperature regime and freezing of the seas. In Nevelsk (a north-west subregion), average annual temperatures are higher, precipitation is lower, and the sea does not freeze, which makes climatic conditions more favorable for plants living in a continental climate with harsher winters.

The results of indicator analysis according to the scales of I.A. Tsatsenkin et al. (1978) completely coincide with those according to the scales of D.N. Tsyganov: the moisture content of the territory is wet-meadow, bordering on dry-meadow, and the soils are quite rich in nutrients, but the values of this scale border on the values of the poor soil regime. Indicators of the soil richness and salinity regime and the degree of pasture digression differ statistically significantly at $p < 0.05$. Although the influence of grazing is weak in both parts of the Crillon Peninsula, it is higher in the northwest subregion. This is related to the population of the northwest coast and the grazing of cattle both by agricultural enterprises and by residents of the surrounding villages. In general, the environmental conditions of the Crillon Peninsula coincide with the conditions of the entire southern Sakhalin (Rozhkova-Timina et al. 2024).

Conclusions

121 plant species, representing 93 genera and 27 families, including shrubby and tree forms, were found in the meadow communities of the Crillon Peninsula.

Five groups of meadow phytocoenoses were distinguished as a result of the dominant classification. Nearly all of them are evenly dispersed over the two study areas. In terms of phytodiversity, the southeast subregion has stronger dominance indices, whereas the northwest subregion has higher species diversity and equitability indices. At the same time, no statistically significant differences were discovered when evaluating the α-diversity characteristics in the two subregions of the peninsula.

Through an indicator analysis, it was found that both subregions of the Crillon Peninsula are in the identical climatic and edaphic conditions. Statistically significant differences were obtained only for the regimes of climate continentality, winter harshness, and soil nitrogen richness (at $p < 0.01$) according to D.N. Tsyganov’s scales and for indicators of soil richness/salinity and pasture digression (at $p < 0.05$) according to the scales of I.A. Tsatsenkin et al. These differences are explained by the climatic characteristics of the peninsular coasts and human activities.

The results obtained allow us to conclude that data from one study location can be carefully extrapolated to the entire Crillon Peninsula. During the extrapolation process the anthropogenic stress and agricultural development should be considered. The environmental factors in their respective locations determine variations in phytocoenose composition rather than its physical location.

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